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SIMPLE ELECTRIC LIGHT APPARATUS.

By GEO. M. HOPKINS.

THE engraving represents, full size, a very simple and easily constructed apparatus for producing an electric light on a small scale for class illustration or for experiment. To the center of the wooden base is attached a vulcanite or well varnished wooden standard, to one side of which a spring carbon holder is secured by the binding post, which screws into the standard. Two brass ears, having apertures for receiving the pivots of the upper carbon holder, are secured to the upper end of the vulcanite standard.

By placing in the U-shaped loop at the end of each holder a small, well pointed pencil of battery carbon, and adjusting the holders so that the points of the carbons touch, and connecting the instrument with a battery of 4 or 6 Bunsen cells, a small but very brilliant light will be produced.

As the points burn away, the upper carbon moves downward of its own gravity. The contact of the points, which should be light, is regulated by a movable weight on the straight end of the pivoted holder.

Figures 3 and 4 represent in section easily constructed batteries which may be used in connection with the light apparatus, and figure 5 shows the manner of connecting the battery with the apparatus.

Both of these batteries are of the type known as the carbon or bichromate, which is a modification of the Bunsen.

The element shown in figure 3 consists of a small jar or tumbler, A, in which is placed a piece, B, of sheet zinc bent up into a cylindrical form, but not joined at the edges. Within the zinc cylinder is placed an ordinary tobacco pipe bowl, C, of large size, having a base, D, formed of plaster of Paris. In the pipe bowl there is a carbon pencil, E, which may be procured from any dealer in electrical apparatus. A wire is inserted with a twisting motion, into a hole drilled in the top of the carbon pencil.

A saturated aqueous solution of common salt is placed in the tumbler, A, and in the pipe bowl (which in this case forms the porous cell) is placed a solution made by dissolving 3½ ozs. of bichromate of potash in 1 one quart of hot water, and when cold adding slowly 1 pound of sulphuric acid.*

Figure 4 represents a battery which is similar to the one just described, but it may be made on a larger scale. In a jar, F, 5 inches high and 5 inches in diameter, is placed the zinc, G, which is a little shorter and a little smaller in diameter than the jar. An ordinary unglazed flower pot, H, 4 inches high, is placed within the zinc, and in it is placed a piece, I, of carbon, taken from a gas retort and cut roughly into shape, so that it nearly fills the pot. A piece of copper wire is wound around the upper end of the carbon. The flower pot, which in this case is the porous cell, contains the bichromate solution, and the jar, F, outside of the flower pot, is filled with a saturated solution of common salt.

A piece of clean coke may be used for the carbon pencil in the light apparatus, and also for the carbons used in the batteries.

While it is best to buy the carbon from dealers in electrical apparatus, it may be prepared as follows: Take clean finely ground coke, mix with it pulverized coking coal, ram the mixture into an iron mould, and expose to the heat of a furnace until the gas is expelled from the coal. The mould and its contents are allowed to cool before the carbon is removed.

Plates of carbon may be cut up into strips by means of a steel point drawn under pressure repeatedly across the plate along the edge of a ruler. The tang of a file answers well for this purpose.

The zincs before use should be amalgamated. This is easily done by dipping them in dilute sulphuric acid (one part of acid to ten of water) and sprinkling on the zinc a little mercury, which soon spreads and covers the entire surface.

To produce the light will require twenty cells of the battery as shown in figure 3, or 4 or 6 of the kind shown in figure 4.

The elements are connected as shown in figure 5. It makes no difference how the poles of the battery are connected with the apparatus.

After long use the porous cells and the carbons should be soaked in warm water.

* This mixture should be carefully handled, as it is destructive to almost everything with which it comes into contact.

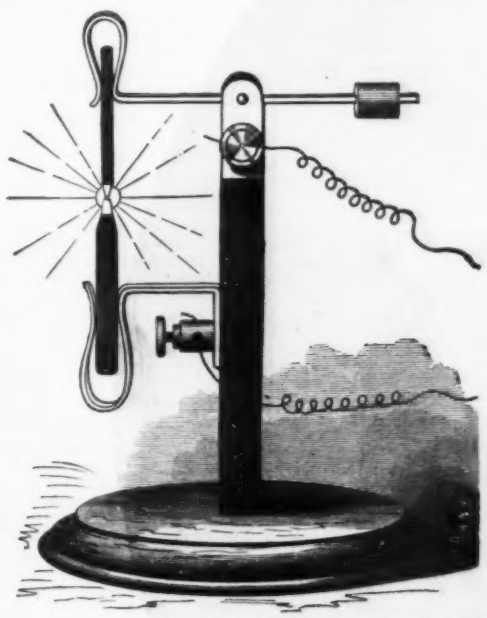


FIG. 1.—SIMPLE ELECTRIC LIGHT—SIDE VIEW.

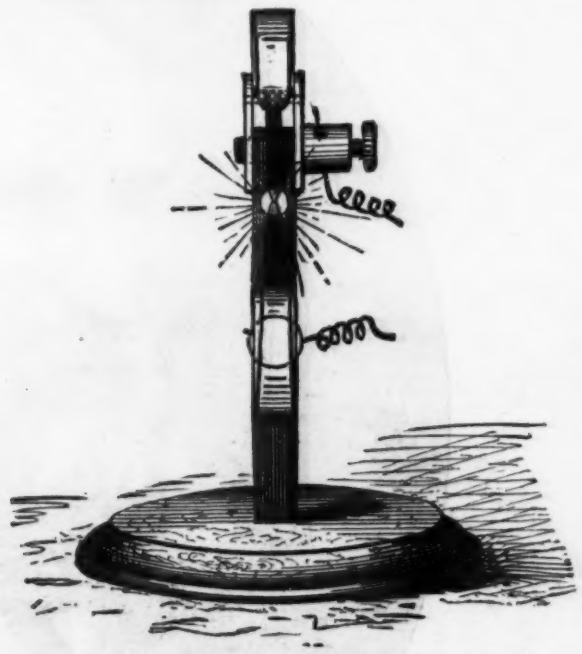
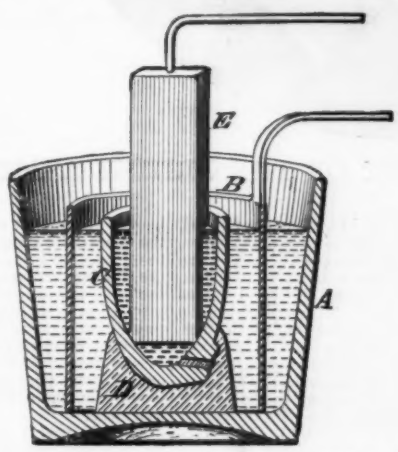
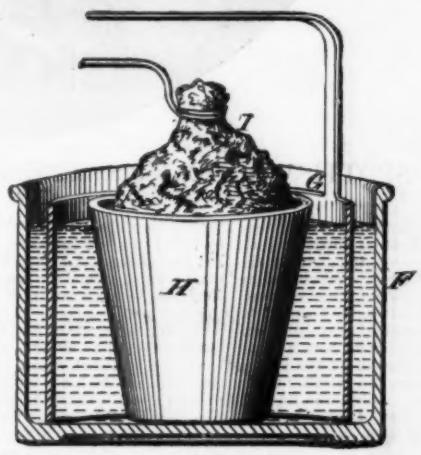


FIG. 2.—SIMPLE ELECTRIC LIGHT—FRONT VIEW.





FIGS. 3 AND 4.—EASILY CONSTRUCTED BATTERIES.

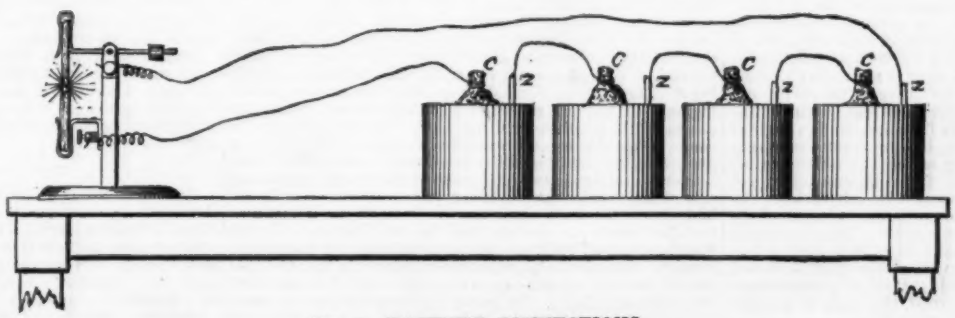


FIG. 5.—BATTERY CONNECTIONS.

GLOBULAR LIGHTNING.

A CURIOUS electrical phenomenon has been lately observed by M. Planté. One of the mica condensers of his rheostatic machine being placed on an insulated metallic plate connected with one of the poles of the secondary battery, and the upper armature being touched by the other pole, an electric spark appears at one of the points of the condenser, where the mica is too thin or presents a slight fissure. This spark moves along in the form of a small, very brilliant, luminous globule, accompanied by a peculiar crackling, and traces slowly on the thin sheet of the con-

denser a deep, sinuous, and irregular furrow. The effect is regarded as throwing new light on the phenomenon of globular lightning. The elements of a condenser are, probably, then formed, in which a moist column of air, strongly electrified, plays the part of the superior armature, the ground that of the lower armature, and the air layer between that of the insulating plate.

BASE MEASUREMENT.

By William B. Whiting, Commodore U. S. Navy.

Of all contrivances, previous to that of the U. S. Coast Survey, for the accurate measurement of a base line, preference is given to that of Lt. Col. Colby, of the Royal Engineers, which consisted of two metal bars, each of different metal from the other, and of unequal proportions of expansion for different temperatures, the exact ratio of those proportions being before determined for each bar, for no two bars, even of the same metal, will have exactly the same ratio. The metals used by Lt. Col. Colby were iron and brass, one bar being constructed of iron, the other of brass. The bars were placed parallel to each other about an inch apart, and firmly connected at the center, but free at the ends. These bars were made of exactly corresponding length at a given temperature, but, of course, their contraction and expansion being in different ratios, they would be of unequal lengths at any other temperature. At either extremity was a steel spring moving on pivots on both bars, an eccentric slot on one bar allowing the length of the spring between the bars to be increased or lessened according to the angle of the spring from perpendicular, which was its position when the bars were of equal length. One end of the spring was extended beyond the bar of least expansion to a point which should bear in its distance from its pivot on the near bar the same proportion to the distance of the bars (or rather the pivots) from each other, as the total expansion of the near bar to the difference in expansion of the two bars. If the bars increased in length, the extended end of the spring would be drawn correspondingly backward, but if they decreased in length, it would be correspondingly advanced, so that this point would always maintain the same distance from a similar point in the spring at the other end, no matter what might be the variation in the length of the bars. A small error would obtain from the relative angle of the spring from the perpendicular, but this error was so very small as to be insignificant, being merely the difference between the sine and the tangent of this minute angle; and even this small error can be eliminated by calculation. An error, still less, will also obtain for variation in length of the springs caused by variation of temperature. The consecutive rods were not brought into actual contact with each other, but the distance between these points on the springs of each rod were carefully measured with the aid of microscopes. It was estimated that, by this method, the limit of possible error did not exceed one inch in four miles.

Hassler used, like Colby, imaginary contacts, measuring, like him, the intervening distance. Prof. Bache, who succeeded Hassler on the U. S. Coast Survey, used actual contacts with a knife-edged agate.

My plan is to employ, like Lt. Col. Colby, parallel metal bars of different ratios of expansion, but instead of having only two, I would have three or more, to consist of iron, brass, and tin, if only three are used, and if more than three, the additional one should be of steel, and if still another be used, it should be of copper, or other metal of a different ratio of expansion from any of the other bars; and so if the number of bars be increased. The advantage of this is that it will give a greater number of differences from which a mean may be obtained. Two bars will only give a single difference; three will give three differences; four will give six differences, and five will give ten. (I think that three will be sufficient.)

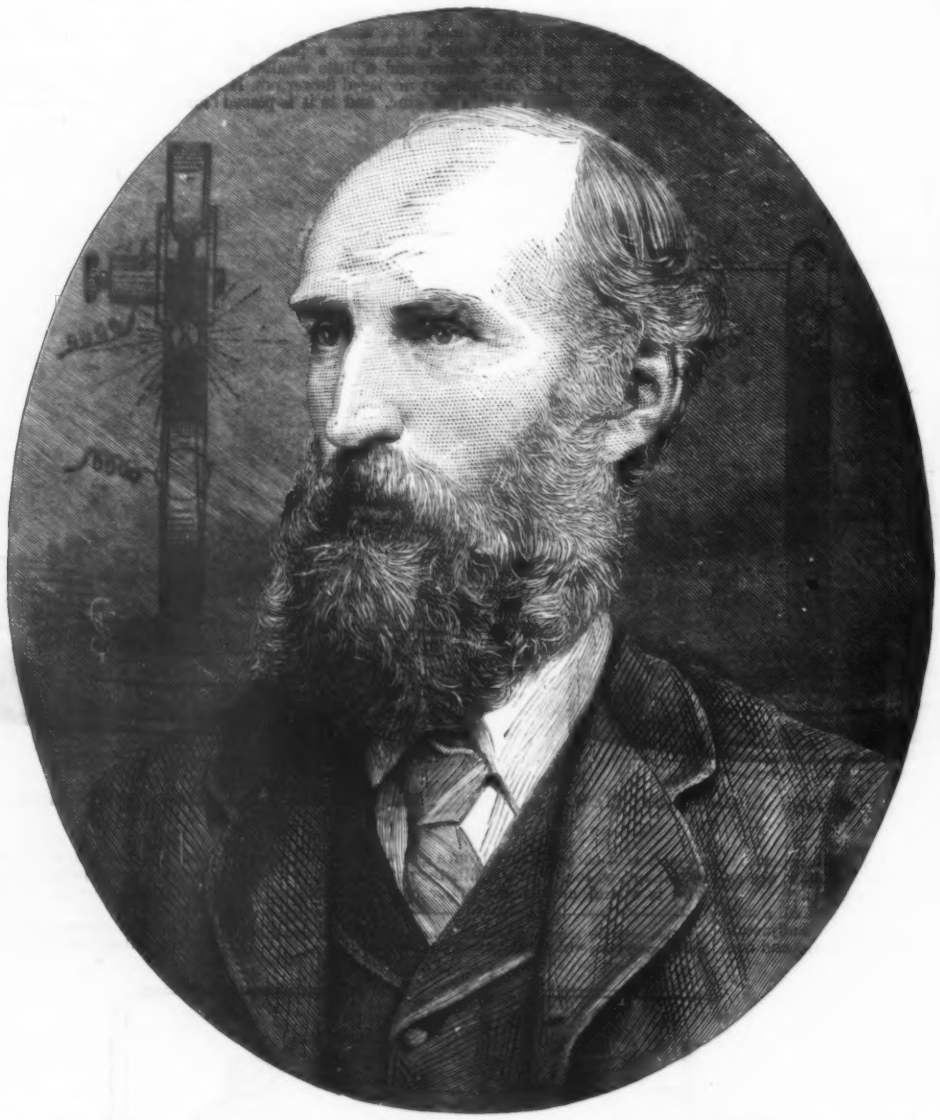
It is evident that with more than two bars the spring correction would be inapplicable, and I would, instead, correct the measured distance by calculation, which is always more accurate than practical measurement. Instead of being at a given distance from each other, the bars shall be in juxtaposition, or only sufficiently apart to avoid friction (which may also be further provided against by rollers between them); they shall be firmly connected together at one end, by being inserted into a cross-piece, by mortise and screws, but free at the other, where a vernier scale with microscope shall furnish means for reading the proportionate expansion. Each bar, except the right hand one in a left hand rod, or the left one in a right hand rod, shall be provided with a fixed vernier scale at the forward end, moving on the next bar to the right or left, as the case may be. A hair line near each end shall mark the limits of the measure, but not the limits of the bars, which shall extend at least a distance of half the length of the vernier scale beyond the hair lines. The hair line of the fixed end shall coincide with the center of the screw heads which secure the bars, and the hair lines of the free (or forward) end shall mark the 0 of the fixed vernier scale on each bar which measures the relative expansion between it and the next bar. Each bar shall rest on independent rollers, upon a common bed, thus giving to each bar independent freedom of motion. At the near (or fixed) end of the bars shall be another vernier scale, but this shall be a sliding vernier, adjusted by a micrometer screw at the end of the rod or cross-piece, the exterior edge coinciding with the edge of the rod, or overlapping on the preceding rod. A hair line shall also cross this vernier, which, by means of the micrometer screw and a microscope, may be made to coincide exactly with the hair line on the other, or preceding, rod, and the difference between it and the hair line on its own rod read off by the opposite and graduated side of the vernier scale. When two consecutive rods are laid down the ends shall not be brought in linear contact, but made to overlap, and the hair lines to coincide *nearly*, the exact difference being ascertained by the sliding vernier. In order to keep the measurements in line, the rods should be laid alternately to the right and left, and constructed accordingly. To protect the bars from the influence of the sun's rays, they should be inclosed in a wooden case (not tin, as used by Lt. Col. Colby); the top and sides should be in sections, so as to be removable at pleasure for the purpose of examining any part of the rod, and also for adjusting the contacts and reading the verniers. In order to make the contacts, the end sections should have that part of the side nearest to the adjoining rod which overlaps that rod omitted. Care should also be taken that they are not jarred or moved after being placed, and for this purpose it is advisable to clamp them after being placed in position, but care should be taken to clamp them only at the rear or fixed end.

The application of varnish or other covering to the bars is, I think, rather objectionable than otherwise (although both Colby and Bache recommend it), as it modifies the ratio of expansion, and that, too, in unequal proportion in different temperatures. I would, therefore, omit it.

The very much greater accuracy of measurement than ever before obtained, attained by the U. S. Coast Survey, where the limit of error was only one inch in nearly nine miles (Lt. Hunt reported that the actual error in some cases was only one-tenth of an inch in six and a half miles), was mainly achieved, I think, by greater care in manipulation and construction, and by the personal intelligence of the superintendent, Prof. A. D. Bache, rather than in the existence of superior excellence in the contrivance. Many of the details and similar care of manipulation can be applied to the method I propose. The comparison of the bars with the standard, adjustment of the trestles, the construction of the bars, making their absorbent surfaces to be in inverse proportion to their absorbent capacity or conducting power, precaution against unequal contraction and expansion of the bars, owing to inequality of temperature, and the noticed difference in that contraction and expansion in rising or falling temperatures, are all conditions, appliances, compensations, and corrections as applicable to this method as to another.

The advantages of my plan, at least its difference from the most distinguished ones that have preceded it, are multiplying the comparisons of the bars, whereby a more accurate mean can be obtained; substituting verniers for the spring correction, and coincidence and continuity of hair lines under powerful microscopes for linear contacts, and the omission of varnish coating.

Improvement, it is believed, might also be obtained in marking the spot of temporary discontinuance of the measurement on account of the approach of night or change of weather, by using a telescope carefully collimated, and pins with plated heads adjustable by thumb-screws and marked with cross hair lines.



Mr. W. SPOTTISWOODE, F.R.S., PRESIDENT OF THE BRITISH ASSOCIATION.

Absorption-Bands of Water, Petroleum, Ammonia, Alcohol and Glycerin.—By J. L. Schönn (*Ann. Phys. Chem. Ergänzungsband*).—On examining, by a direct-vision spectroscope, the light from a petroleum lamp, after transmission through 3·8 meters of distilled water, the author observed two absorption-bands between C and D. A thickness of 1·9 meter of common petroleum absorbed all the blue and violet rays, and showed two closely contiguous absorption bands also between C and D. Several absorption-band were also observed in the light transmitted through column of concentrated ammonia solution, alcohol and glycerin respectively.

MR. WM. SPOTTISWOODE.

MR. SPOTTISWOODE, M. A., D. C. L., LL. D., Tr. R. S., the President of the British Association this year at Dublin, was born on Jan. 11, 1825, being the eldest son of the late Mr. Andrew Spottiswoode, for some time M. P. for Saltash, who was the printer to the Crown and the House of Lords, and the energetic promoter of many of those improvements in the art of printing of which we now witness the fruits. After due preparation, the son proceeded to the University of Oxford, where he became specially eminent for proficiency in his mathematical studies, the results of which are apparent in many profound papers in the principal scientific journals. His "Meditationes Analyticæ" were privately printed in 1847 and following years; and he has long been an earnest member of the London Mathematical Society. General literature also was not neglected, and he gave much attention to that of the East, especially Sanskrit. On leaving college and assuming the active superintendence of a large printing establishment, in succession to his father, he devoted his leisure to the study of physics; and by his long-continued experimental researches in the polarization of light has attained special eminence in that department of optical science. The results of these labors have been, from time to time, laid before the members of the Royal Institution of Great Britain, with brilliant chromatic illustrations, in Friday evening discourses, and in a course of four lectures in 1876, notices of which have been duly given in the *Illustrated London News*, the two last ("Quartz, an Old Chapter rewritten," and "A Nocturne in Black and Yellow") during the present year. In 1874 Mr. Spottiswoode complied with a general request by publishing, in "Nature Series," a little treatise on the "Polarization of Light," of which a new edition, embracing his recent discoveries, is much desired. The practical application of his arithmetical powers has appeared in his conduct as treasurer of the British Association from 1861 to 1874, of the Royal Institution from 1865 to 1873, and of the Royal Society from 1871 to 1878; and all these bodies have flourished under the combination of wise liberality and judicious economy. In 1871 Mr. Spottiswoode succeeded the late Dr. H. Bence Jones, F. R. S., as honorary secretary of the Royal Institution, one of the more important duties of which is providing the lecture and Friday arrangements, in which, aided by the co-operation of Dr. Tyndall and the other professors, he has caused not only pure and applied science, but history, literature, music, and the fine arts to be honorably represented. The Royal Institution, being cosmopolitan in its character, a meeting-place for the scientific men of all countries, has given Mr. Spottiswoode the opportunity of showing much generous hospitality, in which he has been warmly supported by his wife. All these facts prove that his election as President of the British Association in 1877, and his nomination as future President of the Royal Society, in succession to Sir Joseph Dalton Hooker, is no more than a just recognition of his merits both as a worker in science and as a patron, since our more skillful philosophical instrument makers have always found him a liberal supporter of their ingenious inventions. Among these may be mentioned an exceedingly powerful electric induction machine, with which some remarkable effects in vacuum tubes have been produced. In 1876 Mr. Spottiswoode was elected a Corresponding Member of the French Academy of Sciences at Paris; in June last he was made D. C. L. at Oxford, and he received the degree of LL. D. at Dublin on the 22d of last August. Abstracts of his recent address to the British Association were lately given in our SUPPLEMENT. In 1856 he made a brief visit to Eastern Russia, and described his experiences in a "Tarantasse Journey," published in 1857, with fourteen engravings, containing much information respecting the country and native tribes.

The portrait of Mr Spottiswoode on the opposite page is from a photograph by Mr. Chancellor, of Lower Sackville street, Dublin.—*Illustrated London News.*

AN AERIAL METEORITE.

WE have received the first number of the fourth volume of the *Boletin de la Sociedad de Geografia y Estadistica* of the city of Mexico, a very handsome periodical. It contains a number of excellent articles, from among which we find an account of the aerial meteorite observed in Oaxaca, on 6th July, 1874, by D. Lúcas Villafaña. We copy the author's drawing. The aerial meteorite had the form of a gigantic spiral trumpet, suspended vertically in the air, its mouth toward the earth. It was estimated to be about 425 feet long, 200 feet diameter at the widest part of its base, and 76 feet at its narrowest diameter. It had a clear limpid crystal color. It oscillated gently, and remained floating in the air for five or six minutes, when it vanished. There was no wind or rain at the time, although there were clouds, indicative of the approach of rain. Time, 4 P.M.

HEAT IN GRINDING.

IT has been a common opinion that a temperature of from 120 to 130 degrees Fahrenheit was not injurious to flour, but this idea was dispelled by experiments which have been made with flour ground at different degrees of warmth. To determine just how far heat injured the quality of gluten, Campbell's molarimeter was attached to a pair of burrs grinding Minnesota spring wheat, and samples of flour were taken that were ground at 90 degs., 104 degs., 110 degs., and 120 degs. Fahr. respectively. The gluten was carefully washed from these samples and tested on the aleurometer, with the following results:

Flour ground at	90	degs.	showed	48½	degs.	of elasticity.
"	"	104	"	"	42	"	"
"	"	110	"	"	38½	"	"
"	"	120	"	"	34	"	"

Here was a difference of 14½ degrees in the elasticity of the gluten occasioned by a difference of 30 degrees in temperature, and that, too, on identically the same wheat ground on the same pair of burrs. As the elasticity of the gluten is the measure of the strength of the flour, the importance of cool grinding will readily be perceived. Other wheats running on other burrs may not give the same results as these; it would be remarkable if they did, since wheats vary widely in the elasticity of the gluten they contain, and since the mode of milling very materially affects the strength of the flour. But it will be found that in every case an increase in strength will result from decreasing the grinding temperature.

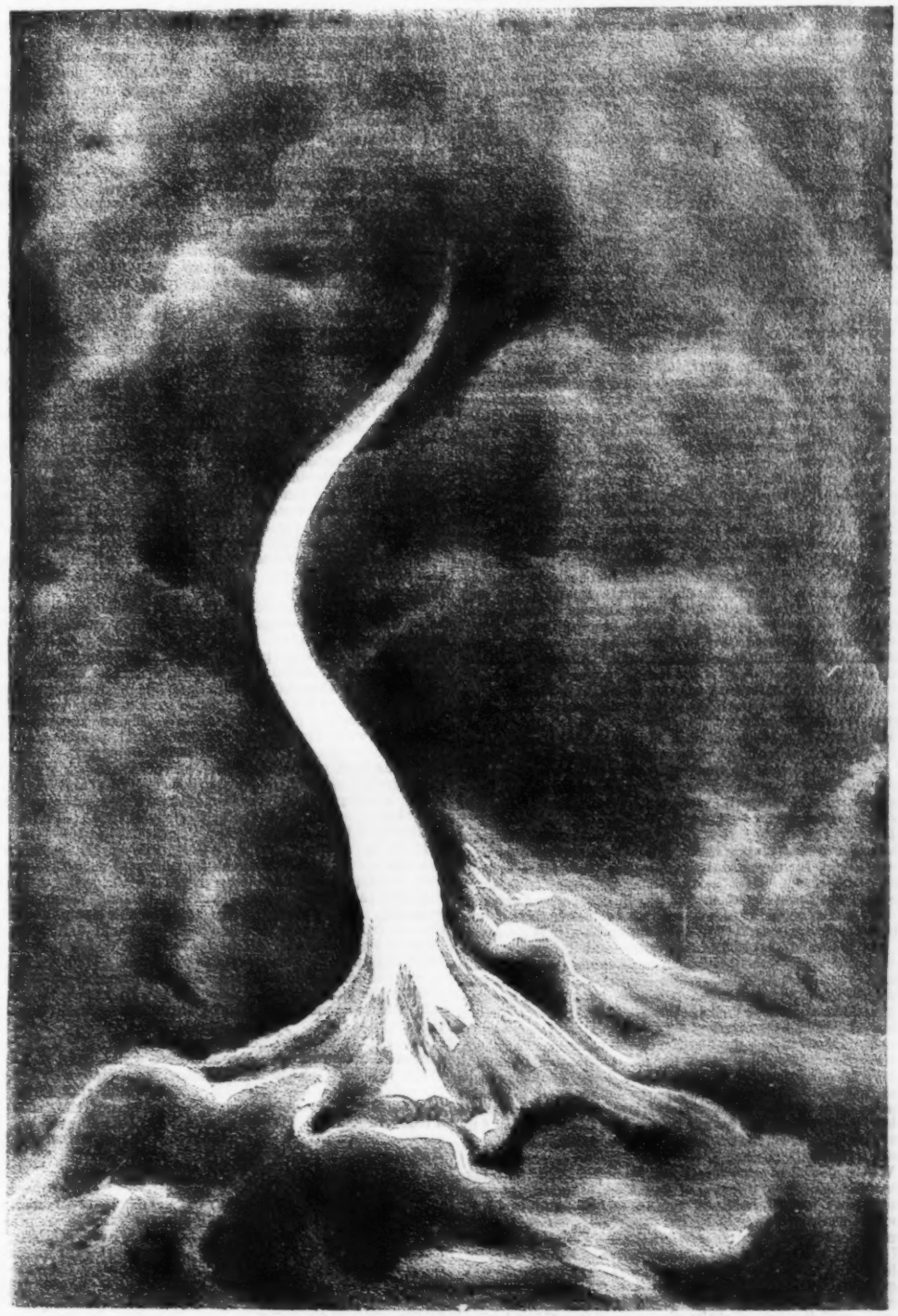
Following the same method of procedure indicated above, samples of flour ground at 80 degs., 90 degs., 100 degs., and 110 degs. respectively were tested on the aleurometer, and gave the following results:

Flour ground at	80	degs.	showed	38	degs.	of elasticity.
"	"	90	"	"	30½	"	"
"	"	100	"	"	33½	"	"
"	"	110	"	"	28	"	"

This simply verifies the former result. The fact that the difference in elasticity occasioned by 30 degrees of heat is not the same in both cases, is due to two facts, viz., that a smaller quantity of gluten was tested in the last case than in the first, and also from the fact that the higher the temperature is the greater relative injury is done by additional heat. The decreasing amount of elasticity which will be found in every case is convincing proof of the truth of the assertion that an excess of heat destroys the life of the flour. At just what degree of temperature flour begins to deteriorate has not yet been determined. Different wheats will doubtless show different results, but probably between 80 and 90 degrees Fahrenheit is the most suitable degree of warmth, beyond which it is not advantageous to go.

Still, it is impossible to lay down a general rule of application for this truth, that the degree of temperature affects the quality of the flour. Not only do the circumstances of localities differ, but those of mills, and the burrs in the same mill. The point which we have endeavored to make in this and the preceding article on the same subject is, that each pair of burrs in every mill requires and should receive separate treatment. No two pair of burrs in any mill will grind exactly alike, with the same amount of feed, and the miller should take cognizance of this fact. By employing the molarimeter he should determine just what feed the burr will stand without heating the chop, and by testing the elasticity of the gluten obtained from the flour ground at higher and lower temperatures he can easily discover at what temperature it is to his interest to grind.

We venture to say that were these scientific tests applied to the burrs of all the mills in the country some very remarkable facts would be brought to light. Some millers would see the reason why their flour has little life, and others would discover that they had been overfeeding some burrs simply because other burrs of the same size and running at the same speed easily ground a certain amount of grain. The whole subject is an important one, and one in which millers should manifest that degree of interest which its connection with their interests demands.—*American Miller.*



AN AERIAL METEORITE.

PLASTER OF PARIS.

M. LANDRIN, according to *Galignani*, has just communicated to the Academy of Sciences the results of long continued studies relative to the different qualities of this substance, and the information he furnishes may be of considerable practical value to architects, builders, modelers, and others whose business requires the use of this material. He finds that the more or less rapid setting of the plaster is due to the mode in which it is burned. Its properties are very different when it is prepared in lumps or in powder. The former, when mixed with its own weight of water, sets in five minutes; while the latter, under similar conditions, takes 20. The reason probably is that plaster in powder is more easily burned than when it is in lumps, and what tends to prove that fact is that when the latter is exposed longer than usual to the action of fire it sets more slowly. Gypsum, when prepared at a high temperature, loses more and more its affinity for water, retaining, however, its property of absorbing its water of crystallization. Plaster heated to the red, and mixed in the ordinary manner, will no longer set, but if, instead of applying the ordinary quantity of liquid, the smallest possible portion is used, say one-third of its weight, it will set in 10 or 12 hours, and then it is less porous, and becomes extremely hard. To prepare plaster for moulding it must be burned slowly for a long time, sufficiently to drive off all its water, and for its molecules to lose a part of their affinity for the liquid. M. Landrin stated that a similar result could be obtained by other means. If the plaster is exposed to the fire of the kiln for a time short enough to allow it to retain 7 or 8 per cent. of its water, it is useless, as it sets almost immediately; if, however, the burning is again resumed, the substance soon loses its moisture, and, if then exposed to the air, it very rapidly retakes its water of crystallization, and then absorption continues more slowly. It can then be used; it sets slowly, but acquires great hardness.

ONE-THIRD of the liquid portion of the sewage of Paris is conveyed to Gennevilliers, a kind of peninsula made by the windings of the Seine below Asnieres. A medical visitor says that he did not discover as much smell as he has often detected in walking over farms manured with guano or in the ordinary manner.

DYEING, BLEACHING, PRINTING, FINISHING, ETC.*

THE BLEACHING OF WOOL WITHOUT SULPHUR.

ORDINARILY wool is deprived of its yellow or grayish tinge by the application of sulphur in different ways, but mostly in the form of sulphurous anhydride, the pungent gas given rise to by the combustion of sulphur in air; this bleaches the wool, but not entirely, and to obtain the desired whiteness it is necessary to drown the remaining yellowing shade by the application of bluing, either with indigo carmine, indigo purple, aniline blue, aniline violet, ultramarine, Prussian blue, or similar substances. This, as a rule, gives satisfactory results as far as the appearance of the cloth goes, but the substances used undergo, more or less, a change through the action of the sun and soap when the cloth has been made up.

A German dyer, named Kallab, has recently invented a proceeding by which wool and silk, as well as other animal fibers, can be bleached and blued in such a manner that the shade withstands milling, washing, and the action of sunlight. Under this patent the wool is first well washed, and then brought, still damp, into a bath of pure water of ordinary temperature, to which has been added a very small quantity of finely powdered purple indigo, say 40 to 90 grains to 100 gallons of water; the addition must be so small that the water, when placed into a white earthenware vessel, has only a faint bluish tinge. The cloth is left a short time in this bath, during which the finely divided indigo deposits upon it; it is then wrung and brought into the bleaching bath.

The bleaching liquor is contained in a wooden well-closed vessel, and consists of a solution of freshly prepared subsulphate of soda ($NaHSO_3$) of 1·0069 to 1·0283 specific gravity, according as there is a necessity for more or less strength. To each gallon of the liquid are then added from three to six cubic inches of acetic acid of 50 per cent., and free from any mineral acid. the whole is then well stirred, and the yarn or cloth to be bleached introduced, after which the vessel is closed to prevent the atmospheric air entering. In this way the indigo, mechanically attached to the cloth, is converted into indigo-white, which latter is absorbed by the fiber, while the sulphurous acid, formed from the hyposulphite, performs the bleaching action. It takes from a few to twelve and twenty-four hours for this operation; when completed the cloth, taken out of the bath, must show a clear white, with a bluish tinge, after having been rinsed in water. As soon as this is attained the cloth is all taken out, drained, and exposed to the action of the air, by which means the indigo is again brought back to a blue color, and gives the cloth a bluish shade. Where the bath has been a strong one, it is advisable to treat the cloth afterward in a solution of crystals of soda of one half to one per cent. Finally the cloth or yarn is washed in clear running water, wrung and dried in the air, or a stove at a temperature of 100° to 110°. The foregoing proceeding may be varied by adding the acetic acid after the bleaching bath, but this deprives the acid of one of its chief functions; for it not only has to retain the indigo-white in process of formation on the fiber, but also to prevent that the blue indigo, which at the beginning adheres only mechanically to the cloth, does not detach itself, and float into the bath. The action of the acid can be easily tested; when indigo, ground damp, is put into a vessel containing water, the latter will for days appear blue; as soon, however, as a little acid is added, all indigo is precipitated.

When bleaching loose wool it is best to add the indigo to the hyposulphite bath, to place the wool in after a quarter of an hour, and half an hour later to add slowly the necessary quantity of acetic acid (one part acid to ten parts water) without taking the wool out. The remainder of the operation is as above.

If after the drying the cloth does not show sufficient whiteness, it is advisable to submit it to a second bleaching without any further addition of indigo, for which an old bath can be used. It is in that case necessary to first test the bath with nitric acid, to find out if it separates sulphur. If this action occur, it is a proof that the old bath still contains subsulphuric acid; in the contrary case it is necessary to add 1-10th or ¼ of the previously added hyposulphite, and to leave the cloth in the bath until the hyposulphite has changed to sulphite of soda; the cloth is then taken out, and so much nitric acid added until the presence of sulphurous acid is easily detected by the smell, and the cloth then reintroduced until it is completely bleached. The first submersion accomplishes the fixation of the indigo on the cloth; the second corresponds with the old method of bleaching with watery sulphurous acid. When loose wool has to be bleached a second time, the bath can be made of a specific gravity of 1·035 to 1·043, and without addition of acetic acid. Such a bath can be regenerated by the addition of nitric acid until it smells of sulphurous acid, and then the addition of metallic zinc.

Where a wool is remarkably yellow, it is advisable to take subsulphate of lime in place of the salts of potash or soda. The former are obtained by adding metallic zinc to a solution of bisulphite of potash; the vessel is then closed, and occasionally shaken; after an hour the clear liquid is poured off (and which contains a little zinc in the form of a double salt of zinc and sulphide of potash), and I used for the bleaching bath. To be able to bleach with hyposulphite of calcium, it is requisite to add milk of lime to the fore-mentioned liquid, until it reacts slightly alkaline. After this a bath of hyposulphate of calcium is prepared without any further addition, the same being of a specific gravity of 1 to 1·028, and the wool added without being previously blued with indigo. The wool is then washed, treated with weak acetic acid, and washed a second time.

When it is desirable to have a white with a greenish tinge, the cloth is passed through a water-bath slightly acidulated with nitric or sulphuric acid. Where a reddish or violet shade of the white is desirable, the cloth is passed through a bath slightly colored to the required tinge.

The strength of the baths mentioned depends upon the degree of color to be removed, and as a rule is taken weaker for silk or other fibers than for wool. The process is, in fact, applicable to all animal fibers, and is said not to be dearer than the usual method, while it is said to furnish a thoroughly fast bluing.

ON AN ANILINE BLACK WHICH DOES NOT TURN GREEN.

I WISH to call the attention of the Society to a particular fact in the history of aniline black. Without entering into details, I will say that my dyeing processes consist essentially in causing salts or metallic oxidizing acids to act upon aniline in an acid solution in presence of the goods to be dyed. These become green, darker and darker, and finally turn black when the oxidation reaches a sufficient point, and the flot remains perfectly limpid.

Besides the novelty of this kind of dyeing, I wish to point out especially the exact part which the metal plays in the constitution of these blacks, and which is quite different from its mode of action in Lightfoot's process. In this latter process the metal has no other effect than simply decomposing the chloric acid, which does not produce a black, into lower oxides of chlorine, which produce a black.

The experiments of M. Rosenstiehl are decisive on this point, and explain perfectly how it is that infinitely small doses of copper, and especially of vanadium, suffice to produce the color.

Indigo blacks, on the contrary, it is remarked that in spite of the acidity of the solutions, the metallic oxides derived from the salts or the acids employed fix themselves upon the fiber in a true combination with the black—a combination much more intimate than that of ordinary lake colors, and very probably in a state of true substitution.

The blacks that I produce will be blacks of metal-anile. One or more equivalents of hydrogen are replaced by one or more equivalents of metal, which gives to the products of ulterior oxidation a special stability because of the stability of the metallic oxides, and of their affinity for oxygen. This is what I said textually in my patents of November 3d, 1874, and in the claim of my English patent of October 21st of the same year I insisted upon the fact that this metallizing action of the metallic salts may either precede or succeed the oxidizing action.

[N. B.—Metallic oxides in contact with organic matter are not necessarily stable.]

I claimed at the same time the application of these metal-anile blacks in printing, but I was stopped by the difficulty of reserving the whites or the other colors associated with the black.

The receipts which have since been given are merely a particular application of my theory, a special determination of the reagents pointed out by me, with the object of not soiling the whites and not destroying colors other than black.

The authors of these receipts, to whom I have imparted my theories and my results, have asserted that the black did not turn green in consequence of a more complete oxidation.

Two very simple experiments enable me to prove that this theory is erroneous, and that mine alone is exact.

Let us take a piece with black and white stripes, printed by Lightfoot's process and subject to greening.

We fix the black by taking it through a boiling beck of acidified persulphate of iron. When the transformation is complete, and the black no longer turns green, we remark that the beck no longer contains any ferric salt, and that all the oxide of iron which came from it may be found upon the black parts of the cloth, while the white is not at all soiled if the proportion of acid was sufficient.

Thus, therefore, aniline black, in fixing itself, attracts iron in a beck so acid as not to deposit a trace upon the white portions of the cloth.

The following example is still more decisive, permitting us to distinguish two phases in the action of the reagent in the former, of which it plays an oxidizing, and in the second a metallizing part. We may fix the black with chromic acid, acidified with sulphuric acid. As soon as a piece printed with aniline black, capable of turning green, has been worked for some minutes in a boiling beck containing a certain proportion of this reagent, the chromic acid is very rapidly reduced, and the liquid, which was yellow, becomes green. At this moment, though the reagent has exhausted all its oxidizing power, the black will still turn green if exposed to sulphuric acid. We may double, triple, quadruple the proportion of the reagent, and may turn the black grayish, and finally destroy it, but still without hindering it from turning green.

If, on the contrary, we work the goods in the beck with the original lot of the reagent for thirty to forty-five minutes, the liquor turns from green to a violet red. At this moment the black is fixed, and has become incapable of greening. It has attracted the total of the chromic oxide derived from the reduction of the chromic acid, and *of which there no longer exists a trace in the bath*, but which may now be found upon the black parts of the tissue. [If not a trace of chrome remains in the bath, asks the *Chemical Review*, to what is the violet red color due? It is well known that certain modifications of the salts of chrome in solution display this color.]

To sum up, aniline black is capable of forming with certain metallic oxides true combinations which give it a peculiar stability. This metallization of aniline may either precede or follow the oxidizing action which transforms it into black. The combination of aniline and of the metal is a true substitution. Aniline black incapable of greening is very probably a black of metal-anile.—M. S. GRAWITZ, *in Bulletin de la Soc. Chimique.*

ON CERIUM ANILINE BLACKS.

THE application of cerium in the development of aniline black has only been transitory, but having used it in printing, I take the liberty of communicating my observations.

This application has more than a merely historical interest, since cerium is a metal which, by its analytical properties, belongs to the aluminum group, not widely remote from the iron group. All the other metals in use for aniline blacks, such as copper, vanadium, tungsten, are precipitable by sulphureted hydrogen or by sulphuret of ammonium as sulphurets, while cerium is only precipitated as a hydrated oxide.

The use of cerium for aniline blacks, like that of the other metals employed, is based upon its property of becoming easily reduced and again oxidized. It forms two series of salts corresponding with its two stages of oxidation—salts of the suboxide, and salts of the oxide. The former are easily oxidized in presence of oxidizing agents, such, for instance, as the chlorates or chloric acid, forming the hydrated oxide of cerium of a red color. The salts of oxide of cerium, on the other hand, are reduced by deoxidizing agents, such as alcohol with muriatic acid, to salts of the suboxide.

It is in virtue of these properties that the chlorate employed in mixtures for aniline blacks is decomposed, and the aniline forms black. The action continues till all the chlorate has been decomposed.

The chlorides and sulphates of cerium are soluble in water; and in my first experiments I made use of the bisulphate of cerium—a salt of a yellow color, soluble in six parts of water. I took 75 grains of bisulphate to 1¾ pint of color, weighing 2 lbs. 6½ ozs., and containing 2¾ ozs. muriate of aniline. The color printed very well, and did not attack the doctors. After printing it appeared of a very light green, and then become of a deep green, after aging for 24 hours at a temperature of 77 deg. Fahr. by the dry bulb thermometer, and 68 deg. Fahr. by the wet bulb. After soaping and passing through an alkaline bath the color finally takes a rich velvety black.

But the bisulphate of cerium, as well as the chloride, is not to be found in the market, though the oxalate of cerium can be procured, a salt of a reddish white color almost soluble in water. It is in a sufficiently fine powder to be mixed with the colors.

On taking, however, 75 grains to 1·75 pint of color an ageing of 24 hours is insufficient, and more than a week must be taken. I supposed that the insoluble condition was the cause of this inconvenience, and I, therefore, treated the oxalate with dilute sulphuric acid in presence of alcohol. On taking 120 to 150 grains of oxalate per 1·75 pint, the color becomes slightly acid, and it is necessary to protect the doctors from its action during printing.

I have used this color for chrome orange styles, on an aniline black ground. When the black is oxidized I fixed the lead with a bath of sulphuric acid at 5 deg. B., and after washing developed the orange by a single passage through bichromate of potash mixed with chalk.

I have not tried if it is possible to succeed better by completely dissolving the cerium in muriatic acid, then neutralizing with the quantity of aniline needful. It is possible that by this means a color easier to apply might be obtained.

In conclusion, I would remark that cerium interesting its use may seem, presents little advantage over the sulphuret of copper. It is true that one-fourth part the weight of a salt of cerium gives a good result, but this reduction is counterbalanced by the high price of the salts of cerium. Consequently these salts have not found any particular practical application, vanadium having appeared at the same time and filled up their place.

Nevertheless, gratitude is due to M. Kruis for having pointed out the properties of cerium, and thus increased the number of elementary bodies applicable in the formation of aniline black.—M. Ch. WEIDINGER, *presented to the Industrial Society of Rouen, in Moniteur de la Teinture.*

PAINTING UPON WOOD AND CANVAS—THE DETERIORATION OF OIL PAINTINGS.*

By R. LIEBREICH, M.D., M.R.C.S., M.R.I.

OIL paintings are subject to various kinds of changes, which may be considered as diseases, requiring different treatment according to their different nature. A science needs to be formed—a pathology and therapeutics of oil paintings. The pathology would have to describe and explain those diseases and their progress, and to develop the methods by which a correct diagnosis could be arrived at in each individual case. The therapeutics would teach the remedies which might be applied either to cure or to alleviate the disease, or at least to stop its progress. A hygiene would follow, which would have to teach how to avoid pernicious influences, and which, besides, while giving precepts for the technical process of painting, would have to forestall those constitutional diseases which, even in cases where no noxious influences can be traced, are the causes of decay, after a comparatively short period of existence. As medical science is above all things based on anatomy and physiology, so the exact knowledge of the structure of a picture would have to be acquired previously to any study of its disease. Unfortunately, direct investigation alone can procure no such exact knowledge; on the contrary, we are obliged to enter upon a minute historical investigation of the material as well as of the technical methods adopted by artists of different schools and different periods.

The excellent works of Cennino Cennini, Mérimée, Sir Charles Eastlake, Mrs. Merrifield and others, have already furnished most valuable material; but still the field for investigation remains unlimited; for, in order to enable us to secure the conservation of each valuable painting, we ought to know exactly how it was made. The artists of the present time would spare infinite trouble to the investigators of future times if, along with their works, they would leave the account of their practice in the case of each picture. A treatment without exact knowledge of the normal condition, as well as of the nature of the disease, is, as we shall see, as dangerous for the picture as it would be in the case of living beings.

Professional restorers of pictures admit this danger in a general way; each of them, however, is convinced that he himself, by his personal knowledge, skill and care, knows how to avoid it. The public pays too little attention to the subject, and therefore it occurred to me that it might be useful to give a short account of what we know about this question, of the changes to which oil paintings are exposed, as well as of the means either to avoid or to cure them.

We have to consider, first, the material on which the artist has painted, that is, as far as oil painting is concerned, principally wood and canvas.

Secondly, the priming, that is, the substance with which the surface was prepared in order to be made fit for painting.

Thirdly, the painting itself, that is, the pigments and vehicles used for it, and the liquids that were added during the painting, the mediums, meguilp, siccative, varnish, essential oils, etc.

Fourthly, the coat or coats of varnish spread over the picture.

The wood on which a picture has been painted may either warp, or get chinks in it, or become worm-eaten, or even altogether rotten. Against warping, the remedy usually applied is moisture. If the panel is very thick it is first made somewhat thinner; then the back is moistened, and the picture is left to lie on its back for twelve to twenty-four hours, after which time it will be found to have bent straight. Of course this must not be continued longer than necessary, otherwise the convex surface, instead of becoming plane, would become concave. When straight, the picture is kept so by beads which have to be adapted in a particular way, a certain degree of shifting being allowed for the expansion and contraction of the wood.

Cracks in the wood are drawn together by inserting pieces of wood of a special shape.

Sublimate solutions are employed to destroy worms.

Trifling losses of substance are replaced by cement. Small portions of rotten wood, not extending too near the painting, are cut out and replaced by wedge-shaped pieces. If, however, the greater part, or the whole substance of the panel, is rotten, the picture must be separated from it and transferred to new wood, or rather to canvas.

This was first tried by Hacquin in Paris, and was performed successfully upon many pictures, and, among others,

* *Textile Manufacturer.*

* Lecture delivered at the Royal Institute of Great Britain, 1878.

upon one of Raphael's Madonnas, in the Gallery du Louvre, and upon Sebastian del Piombo's "Resurrection of Lazarus," now in the National Gallery. The process no longer appears so very marvelous; it is generally executed in the following way:

First of all the surface of the picture is pasted over with gauze and paper; after that the wood is made straight by moistening, or, if necessary, by making incisions with the saw, into which cuneiform pieces of wood are driven. By means of a tenon saw the panel is to be sawn into little squares, which must be removed by a chisel, and in this way the thickness of the wood is reduced to half an inch; it is then planed until it becomes no thicker than paper, and the rest is removed by means of a knife and with the fingers. The painting being thus severed from its basis, it can be fixed on canvas, if the priming is sufficiently preserved. In the opposite case, a mixture made of chalk and glue, or something of the kind, must be put on first, and very evenly smoothed after being dry. This done, the new canvas has to be fixed upon it by means of a mixture of glue, varnish and turpentine, and the substance of the picture pressed tightly and evenly against it by means of warm irons.

In order to avoid deterioration, the most minute precepts have been given for preparing the panel. It has to be taken from the best oak, or nut trees, or cedars. The wood is to be cut into boards during the winter-time, and kept till autumn before being dried; it can then be prepared only in the following spring, etc. It would certainly be preferable to give up wood panels altogether for large pictures, and only to think of means to make the canvas stronger. For small pictures, panels offer certain advantages, and can be more easily preserved from decay.

In the canvas we meet with the results of injuries or spontaneous decay. A rent may be mended by rags of linen stuck at the back of the picture. Even a hole may be filled up by pieces taken from other decayed paintings. If the picture is considerably damaged, it will be best to line it. But if the whole canvas is rotten and tattered, it will be preferable to sacrifice it by pulling off the threads one by one, after having secured the painting itself by pasting paper on the front of it. This done, the painting is transferred to another canvas in the same way as those removed from wood.

There are different modes of priming, which may be brought under two principal heads: the distemper and the oil priming.

1. The canvas is distempered by a mixture of chalk or plaster and paste, or glue, which may be laid on raw, unbleached canvas, or this latter may be beforehand prepared with glue or paste. Several coats of this mixture must be put on in succession, one being perfectly dry before the next can be applied. Many of the older oil paintings are painted on such ground. It has the advantage of being quicker prepared, of absorbing the excess of oil, of permitting the color to enter into the priming, and to dry quicker, and, moreover, of containing a white absolutely innocuous to other colors.

The inconveniences, on the other hand, are: that it more easily breaks, and under the influence of humidity separates from the canvas.

2. The oil priming consists of several coats of oil colors. As each of these must be perfectly dry before the next is laid on, and as, moreover, time must be given to the whole to dry completely before painting upon, in order to avoid the sinking in of the colors, the whole preparation is much slower than the distemper. Nevertheless it is now generally adopted.

Rey, in France, has pointed out a process which is a compromise between the two methods; he begins by distempering, and after several coats of distemper, having dried one after the other, he puts a coat of oil, which, as it were, changes the distempered ground into an oil color ground.

With oil priming it is of importance that the principal color be white lead, to which are added comparatively small quantities of yellow, black, or other colors. For a whole century a school, that of Bologna, predominated in Italy, which abandoned this principle. During the second half of the seventeenth and the first half of the eighteenth century most of the Italian masters of other schools followed its example. Probably for the purpose of obtaining more easily the desired effect of the chiaroscuro they painted on a brownish red priming, which consisted of bolus mixed with umber. Not one of those pictures has kept its original coloring. Not only has the priming caused all the dark parts to grow much darker, but it has destroyed, or nearly so, all the glazing, so that only those colors can be recognized which either contain white or are glazed on white. I can show you numerous instances of this, for, on account of the extreme fertility of this school, there is little difficulty in procuring pictures of masters of that time or of their pupils.

Wood priming does not require the same elasticity as that of the canvas, which ought to be capable of being rolled. Therefore the priming of the wood shows less variations. It is generally composed of chalk or plaster, tempered with starch, paste, size or glue, and more or less thickly laid on. In some pictures of different centuries we find, either between the wood and the priming, or between the priming and the painting, canvas, and exceptionally even paper.

The diseases of the priming are not of a very complicated nature. They manifest themselves principally in three different ways: 1, by cracks in the priming itself; 2, by the severance of the priming from the painting; 3, by the severance of the priming from the wood or the canvas. The third disease is by far the most frequent, especially among pictures on canvas distempered with paste. If small pieces only are scaling off or blistering, they are fixed again to the ground by letting a solution of size pass between the detached part and the canvas, and pressing both gently together. If the deterioration extends over a considerable surface, the picture has to be lined. While this is being done, and while the gluing substance penetrates into the picture, the detached parts are pressed on again with slightly heated irons. If the whole priming threatens to come off, it will be better to take the picture entirely from the panel or canvas, and to transfer it to a new canvas.

I shall show you examples illustrating the before mentioned points, and among them two pictures, one in oil, taken off from canvas, the other in tempera, taken off from wood. Both of them, strange to say, have escaped destruction without having been transferred to a new canvas, and without being covered with paper, as is usually done, before taking them off. They show you the painting by itself from both sides. I have, of course, used every precaution in bringing them safely over from Florence, where I happened to discover them carefully stowed away among heaps of old pictures.

We come now to the most important part of the picture, the painting itself. We meet very often with the idea that the old masters had been in possession of colors, that is pigments, the knowledge of which has been lost, and that this accounts principally for the difference between the oil painting of the fifteenth and sixteenth centuries, on the one hand, and that of the eighteenth and nineteenth on the other. But this is a great mistake. We know perfectly well the pigments used by the old masters; we possess the same, and a considerable number of new ones, good as well as bad, in addition. In using the expression of good and bad, I am principally thinking of their durability. From this point of view the pigments can be placed under three headings:

1. Those that are durable in themselves, and also agree well with the other pigments with which they have to be mixed.

2. Such as when sufficiently isolated remain unaltered; but when in contact with certain other pigments change color, or alter the others, or produce a reciprocal modification.

3. Those which are so little durable that, even when isolated from other pigments, the mere contact of the vehicle, the air, or the light, makes them in time fade, darken, or disappear altogether.

The old masters used, without reserve, only those belonging to the first of these three categories. For those belonging to the second they imposed on themselves certain limits and precautions. Those belonging to the third they did not use at all.

That some of the modern masters have not followed these principles is not owing to a lost secret, but to the fact that they disregarded those well known principles, and even consciously acted against them. In Sir Joshua Reynolds' diary, for instance, we read that in order to produce certain tints of flesh, he mixed orpiment, carmine lake and blue-black together. Now, orpiment is one of the colors of the second category, carmine-lake one of the third. That is to say: orpiment, as long as it remains isolated, keeps its brilliant yellow or reddish-orange color; but when mixed with white lead it decomposes, because it consists of sulphur and arsenic, and it, moreover, blackens the white lead, because the sulphur combines with it. Carmine-lake, even if left isolated, does not stand as an oil color, and therefore has been superseded by madder-lake.

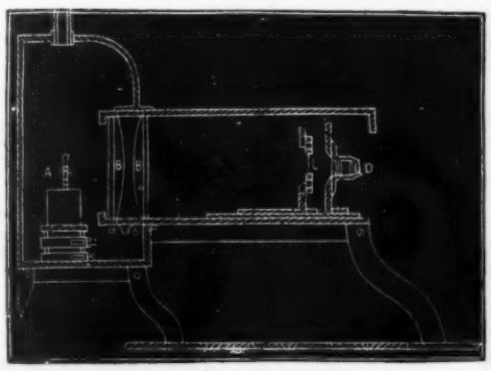
Unfortunately some of the most brilliant colors are perishable to such a degree that they ought never to be used; yet, it seems to me, that just in one branch of art in which of late remarkable progress has been made, I mean landscape painting, the artists, in order to obtain certain effects of color not easily to be realized, do not always resist the temptation to make use of a number of pigments, the non-durability of which is proved beyond doubt. However that may be, I think it pretty certain that the pigments in themselves play only a subordinate part in the deterioration of oil paintings, and that the principal part belongs to the vehicle with which the colors are ground, and to the liquids which are added during the painting. I hope, therefore, you will excuse my making some elementary explanations about these liquids.

PHOTOGRAPH ENLARGEMENTS.

THIS invention, by Messrs. Warlich & Cadett, of England, has for its object the production of enlarged photographs direct from negative or positive pictures.

A condenser is placed at the proper distance from the light to condense the rays thereof, the said condenser being

Fig. 1.



hollow, so as to allow of being kept filled with water or other liquid, and by means of an arrangement of pipes water or other liquid or solution of any substance that may be considered fit for the purpose is made constantly or at intervals to flow through the said condenser for the purpose of keeping it cool.

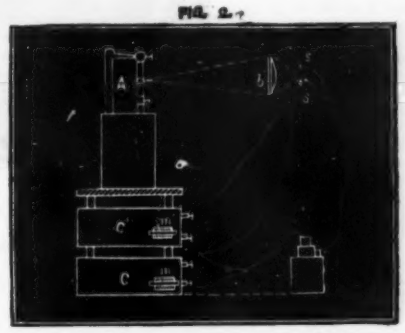
The apparatus which holds the said condenser has also a similar arrangement, by which liquid can be made to flow through it for the purpose of keeping it cool.

Glass condensers, in place of the hollow condensers just described, can be used for the purpose of this invention, but in such case it would be desirable to interpose between the light and glass condenser a glass trough or transparent receptacle for water or transparent liquid, having arrangements for changing or flowing the water or liquid through the same. Such receptacle for flowing the water or other liquid can be formed by making one face of the lens a side for such receptacle, a plate of glass forming the other side of the trough; or the space between the condensers, when two or more are used, may be used as a water or liquid compartment.

In cases where the heat would be excessive a trough or transparent receptacle might be used, in which the picture to be taken is immersed in water or other fluid, which is kept circulating through the trough or receptacle, or is changed by means such as described. On the side of the condenser, from which emanate the condensed rays of light, and at a proper distance from the said condenser, is placed the positive or negative picture to be enlarged, and at a still greater and proper distance in the same line a lens is placed parallel and concentric with the said condenser. The condensed rays of light, on leaving the said condenser, pass through the negative or positive picture to be enlarged, according to the several densities of its different parts, and are then taken up by the above lens, the result being that an image of the above positive or negative picture is projected at a proper focus, and the said image is made to project upon any suitable surface sensitive to light.

When the electric light is used an arrangement is, or may be, employed for keeping the light central with the said condenser and lens, which it does by means of clockwork or

FIG. 2.



otherwise, and utilizing part of the heat evolved from the light.

In using sunlight the box or lantern used with artificial light is not necessary, and the rays of light are projected into the said condenser by the usual means.

Fig. 1 shows in outline the arrangements for producing enlarged photographs.

Fig. 2 is a view in outline of arrangements for keeping the light central with the condenser or lens.

Fig. 3 shows a form of hollow lens.

Fig. 4 shows an arrangement of two lenses or condensers, with chambers at back and front.

Fig. 5 is a front view of Fig. 4.

Fig. 6 is an arrangement with a separate trough or receptacle placed in front of the lenses.

A is the point where the light is placed; B, the condensers; C, position of negative or positive picture; D, lens or lenses placed parallel with the condensers, B; E, position for enlarged negative.

It is to be understood that the drawing is simply for the purpose of exemplifying the method adopted, as the positions of the negative or positive picture, the lens, and the enlarged image depend entirely upon the operator and the subject to be treated.

The condenser or condensers, B, receive the rays of light from A, and such rays are condensed and pass through the negative or positive picture, C, to be enlarged, and are then taken up by the lens or lenses, D, and projected at the proper focus to produce the enlarged image at E from the said negative or positive picture, C. The condensers, B, are, as before described, hollow, to allow a continuous flow of water or liquid through the same, the water or liquid issuing in at *a*, passing upwards through one condenser, and thence by the pipe or other means conveyed down and into the second condenser at *b*. It thence flows upwards and out by a pipe or other means from the upper part. By this continuous flow of water or liquid through the condensers the same are kept cool and insure the efficient working of the arrangements.

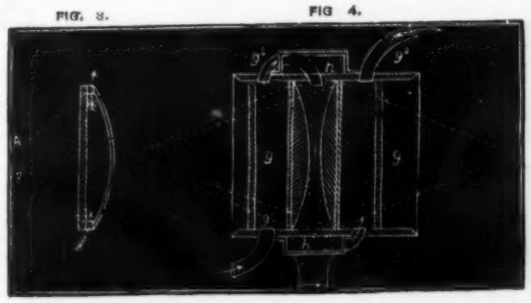
The arrangements shown in Fig. 2 are placed so that they do not interfere with the rays from the condensers to the lenses, and such arrangements are for keeping the light central.

In any part within the path of the rays is placed a lens, b^3, in front of which and at the focal point on either side thereof are springs or means, s, s^1, which by the effect of the heat from the focus of the lens make contact with the electrical communication, the result being that by such contact the magnets, m, m^1, act upon detents which free clockwork or other means inclosed in chambers, c, c^1, and thus the lamp is raised or lowered to keep the light central with the condensers and lenses, as before described.

The action is as follows: Suppose the light falls too low, the result would be that the focal point between the springs

FIG. 3.

FIG 4.



or means would rise and fall upon s^1, and contact would be made by expansion of s^1 through heat, and communication would be made by electro-magnet, m^1, in chamber, c^1. The detent would thus be released, and the lamp raised until the light assumed its normal position between s and s^1, as shown. If the light be too high the focal point would fall and act upon s, and, by the electrical communication, the magnet, m, would act upon the detent and lower the lamp.

In Fig. 3 the water or other fluid which circulates between,

and in the direction of, the arrows is principally the refracting medium.

In Fig. 4 the water or other medium flows in receptacles, of which the face of the lens forms one side, the other side being formed by glass, *g*, which, with the condensers, is inclosed by a suitable chamber of the ordinary kind, around which is formed a hollow chamber, *h*, for the water or other liquid to flow through, so as to keep both the framework and the parts holding the lenses cool.

The exterior view (Fig. 5) shows, by the arrows, the entrance and exit of the water or other liquid to the exterior of the case, A. The openings, or pipes, at g^1 admit the liquid, as shown on Fig. 4, same issuing from same at Fig. 2.

It is to be understood that arrangements are made in each case for carrying the condensers, so as to allow of the circulation of cooling liquid as may be required, substantially similar to the arrangements shown in Fig. 4.

It is also to be understood that where more than one condenser is used the water or liquid compartments thereof may be connected, as described, but be independent of each other as regards the flow.

FIG. 5.

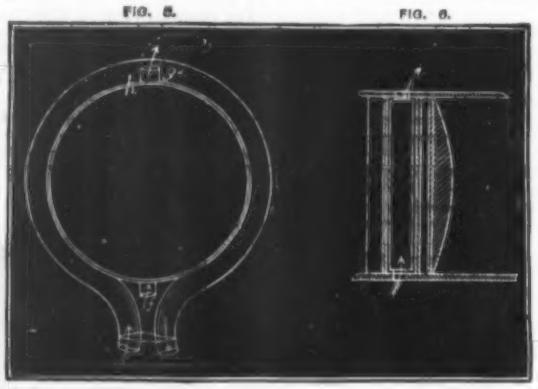


FIG. 6.

MATT VARNISH.

IN the *Photographische Correspondenz* Herr Plohn gives the following formula for a matt varnish which, when poured on the back of the negative, gives it an opal, glass-like appearance, and facilitates retouching by sun or petroleum light, as well as the printing in direct sunlight. The ingredients of the varnish are—

Ether	280 grammes.
Alcohol of 36°	200 "
Benzine	140 "
Sandarac	16 "
Thin, fluid collodion	200 "

M. LIEBERT ON PORTRAITURE.

IF a study of lighting is indispensable to render justice to the expression of every face, and put in relief all that may be of beauty in the human face, the choice of a suitable pose is not less important in order to secure a good likeness.

To make a portrait means to represent an individual in his habitual attitude. It is necessary, therefore, that the pose chosen is that which is the most characteristic of the subject to be represented.

The first condition is that the attitude should be a good one; that it is in harmony with age, stature, contour, and habits of the individual in question. In the second place, the pose should represent the model at its best. For this reason a studied attitude must be avoided, as well as any stiff or formal one, which sometimes overcomes the sitter when placed opposite a camera. It is necessary to observe the model, and assist him in assuming a position natural to him, and, moreover, to distract him as much as possible so that he may not be forever thinking of the fact that he is having his portrait taken. It is in this way that one gets at last to take nature by surprise, as it were, and to secure a confiding and intimate expression, instead of the conventional portrait, which, no doubt, gives the features mathematically correct, but lacks all life and animation. It is a living being one desires to have a representation of, and not a cold, inanimate statue.

The great difficulty, nevertheless, is to choose an expression which accords best with the *ensemble* of the portrait, for, according to the pose and attitude of the body, the expression of the face will give a more or less correct character of the individual. As soon as the right sort of expression has been observed, then every effort, by means of conversation, etc., must be made to maintain that expression on the face of the sitter.

Changes in the expression are so rapid and so fugitive that it is very desirable to secure them as instantaneously as possible upon the collodion plate. Unfortunately, in the studio, this is impossible; it becomes necessary, therefore, to refresh and reanimate the expression during the pose, a matter which does not present insuperable difficulties. The result is obtained by conversing with the model, and in giving rise to sentiments which one desires to see reflected in his visage. It is not by employing cold and formal cautions, nor by the warning "Now don't move," which have a more or less disagreeable effect upon nervous people, that a natural and true expression is secured, for one cannot call up pleasant features and lines by word of command. It is only when one feels at one's ease that this is shown in the face. It is necessary to identify one's self in some way with the model, and in this way give rise to sentiments within the latter which shall call forth the expression you desire, and which appears to you to accord with his pose. It is in this way that the photographer produces a work of art, and becomes an artist.

To secure a good result it is very important that the photographer should be alone with his model, for the least distraction is to compromise the success of the operation. Many ask their sitters to smile, and to remain perfectly motionless, looking at some fixed point—a reason why so many portraits are ugly and unlike, for the sitters wear a grimace, the result of muscles being kept at tension. In others there is a fixed or vacant look which proves that the photographer has in no way been able to control the expression of his sitter.

A question of equal importance in connection with the true rendering of a portrait is the dimensions—or, rather, the proportion of space—which the model shall occupy. A large and powerful man should obviously occupy more space and appear bolder on the picture than a small and delicate individual. It would be absurd, for instance, to let a child occupy the same space as a full-grown man of six feet; the child would appear an infant-prodigy, and the man a dwarf. The corpulence of the model may be taken as some sort of guide, and the accessories, it should be remembered, must always be in harmony with the character of the models.

In the case of standing portraits, the individual will always appear greater the less sky there is about him and ground under his feet, the surroundings of a portrait thus having considerable influence upon the apparent proportions of the model.

Generally speaking, three kinds of portraits are made in photography: Full length, half length, and bust pictures. The full length is that which gives the most complete likeness, for we have the individual here complete, in his ordinary position, and in proper proportion. This class of portrait is, however, the most difficult to execute, whether in respect to securing a likeness or harmonious picture; the placing of arms and legs, and studying to secure proper equilibrium, all add to the difficulty.

Sitting portraits, in which the whole of the sitter is shown, do not offer less difficulty because of the imperfection of the lenses with which we have to deal, and which are prone to exaggerate and deform. Legs or feet extending forward are among the main difficulties to contend against, and the aim of the photographer always is to secure all portions of the sitter being as nearly as possible in the same plane.—*Traité Complète de Photographie Pratique.*

DEADLY EFFECTS OF A PHOTO CHEMICAL.

Death of Professor Fischer, of Prague.—Another death is recorded from the effects of cyanide of potassium, and this time the circumstance calls for something more than a passing notice in a photographic journal. It seems, indeed, very much as if Professor Fischer has lost his life in his endeavor to be of value to the photographic profession by rendering harmless the deadly poison with which we have frequently to deal. Professor Fischer occupied the chemical chair at the Prague High School, or Gymnasium, and it was his idea that cyanide of potassium might be rendered harmless as a drug—or its poisonous effects, at any rate, very much diminished—by admixture in some way with sal-ammoniac, while, at the same time, it could be employed by the photographer with no less efficiency.

We suppose from Professor Fischer's action that he had really succeeded in using the mixture for photographic purposes, and it answered as a solvent quite as well as the cyanide solution alone; but on the point of its poisoning properties he appears to have been woefully mistaken. In the presence of his assistant, and informing the latter what he was doing, he raised a solution of cyanide and sal-ammoniac to his lips, calling upon his companion to witness how harmlessly the potion would work. A chemist cannot express confidence in the uninjurious nature of a liquid better than by swallowing some of it, it may be argued; but if Professor Fischer had been an older and more experienced chemist—the poor fellow was but twenty-five years of age—he would hardly have adopted this rather foolish and sensational mode of procedure. However, he is not the first philosopher who has lost his life from overweening confidence in his own work.

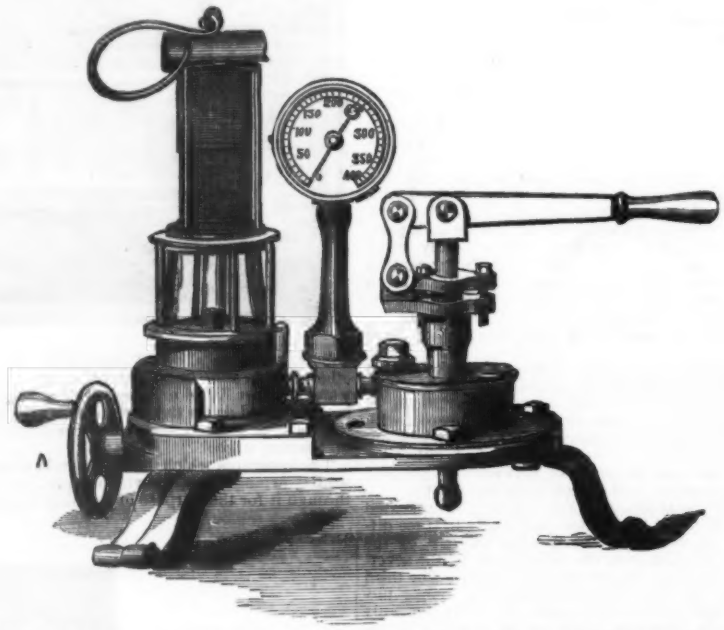
No sooner had he tasted the mixture than he seems suddenly to have been assured of his foolhardiness, and to have repented of his rashness; he besought his assistant to go at once for medical assistance, but ere this came it was too late. The subtle poison did its work in a few minutes, and the Professor was in a state of coma before aid was at hand.

If a chemist in his laboratory is unable to secure assistance under such circumstances, photographers must see at once how dangerous is a case of poisoning with cyanide of potassium. We may say, in a word, that there is no antidote for this virulent compound. All that can be done, pretty well, is to employ an emetic at once, and to use the stomach pump. If an emetic be not close at hand—and it rarely is, except in some well-ordered laboratories—the best thing that can be done is for the patient immediately to put his finger down his throat until he touches the tonsils. This will have the effect, in nine cases out of ten, at any rate, of causing him to vomit immediately, and thus the matter may be thrown out of the stomach within a few seconds of its having been swallowed. A dose of warm water, or warm mustard and water, or sulphate of zinc, if it can be procured at once, will renew the vomiting, and if these are administered in time, it is the best thing that can be done for the patient.

One patient whom we saw within four or five minutes of his having swallowed by mistake a small dose of cyanide solution was already in a state of coma, with his jaws rigidly set, and all attempts then to get him to swallow an emetic were impossible, unless extreme violence had been used to force open his mouth. He vomited, but not until a minute or two had elapsed; and as he had swallowed the poison on an empty stomach, the solution did its work very rapidly. The use of the finger is, therefore, the only thing that can save one under some circumstances, and photographers should bear this simple means in mind. A physician, the other day, informed us that he made use of the expedient with success when he swallowed a pin on one occasion. He was aware that the instrument might place his life in jeopardy, and without a moment's thought succeeded in making himself vomit. To his inexpressible relief the pin was at once thrown out, and he was once more a happy man. —*Photographic News.*

THE ODLING SAFETY LAMP.

WE give an illustration, from which it will be seen that the mechanism for unlocking the lamp is sufficiently compact to be portable, and places it beyond the reach of the miner to open his lamp without its assistance. The ring of the lamp to which the reservoir is screwed is provided with a recess containing a strong spring, which, pressing upon a stud or bolt, causes it to project below the ring in such a way that when the reservoir is screwed in place the stud is forced into a hole drilled in the top of the reservoir and effectually locks the lamp. The spring is inclosed so that it can neither be operated on by any instrument nor even by a powerful magnet. The mode of unlocking the lamp is as follows: The reservoir contains two cylindrical vertical chambers communicating with one another, one of which contains a small ram, whose upper end just fits the hole into which the locking bolt drops, and the other has a small hole in the outer side through which water is forced by means of a small but powerful hand pump. The ram requires a pressure of about 400 lbs. per square inch to lift it, when, the locking bolt being raised, the reservoir can be unscrewed from the lamp either to relight the latter or be refilled with oil. The position of the cylinder prevents the insertion of an axle or any other instrument by which the spring can be raised. The reservoir, as will be seen, is fixed to the platform of the pump, which contains a supply of water, by means of the handle, A, and if the pump be kept under proper charge, it would be impossible for a miner to expose his light without breaking the glass and running the risk of certain detection.

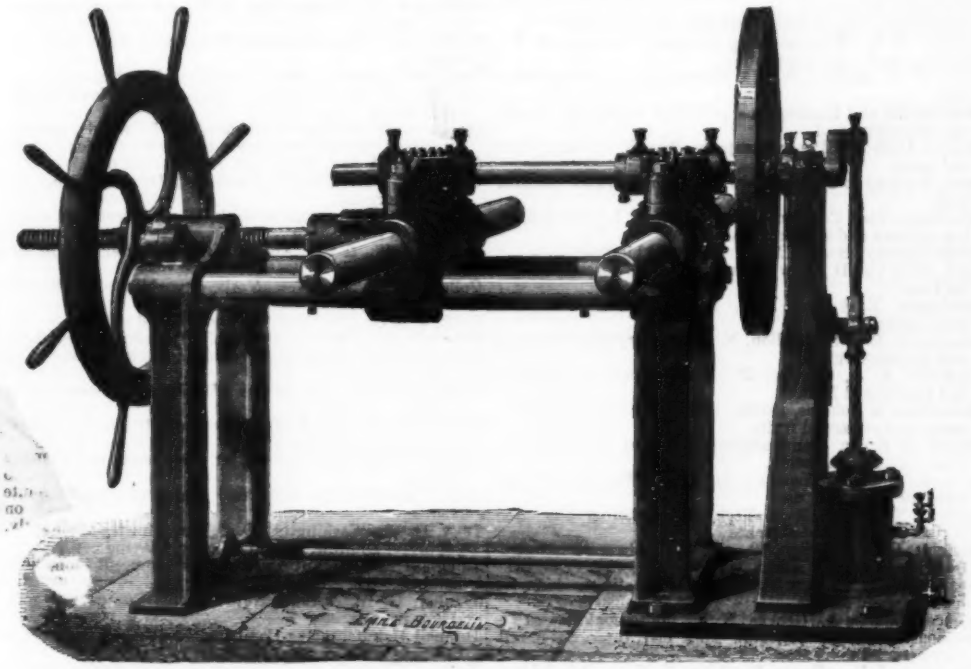


THE PARIS EXHIBITION—THE ODLING SAFETY LAMP.

THE consumption of cotton by American manufacturers was greater by 110,000 bales in 1878 than in 1877. The yield of the staple in the U. S. exceeds that of any year on record.

IMPROVED SILK-FINISHING MACHINE.

WE illustrate in the engraving below a silk yarn finishing machine at the Paris Exhibition, forming part of the extensive collection of MM. Buffaud Frères, of Lyons. This machine is capable of finishing from 45 lbs. to 55 lbs. of silk per hour. It is driven either by an engine direct, as shown in the engraving, or from a strap. In treating black silk, steam-heated boxes are employed to give the requisite luster to the fiber, and with colored silks a cylinder filled with steam is employed for the same purpose. The requisite tension is given to the yarn by means of the hand-wheel at one end of the machine. Our engraving is borrowed from our contemporary the *Revue Industrielle*.



SILK FINISHING MACHINE AT THE PARIS EXHIBITION.

MACHINE FOR SHORTENING AND WELDING TIRES.

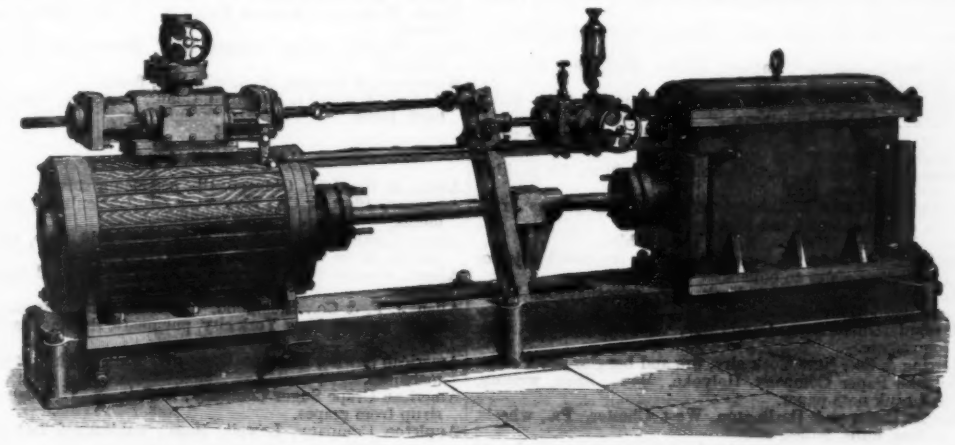
A VERY handy machine for shortening and welding tires has been exhibited at Paris by Messrs. Dandoy-Mailliard, Lucy & Co., of Maubeuge, France. It consists of a solid base support, which is placed on rollers, so as to be readily moved close to the forge. The bed support has a concave top, on which two pairs of toothed jaws are arranged. The tire is rigidly clamped between the jaws in such a manner that the heated portion of the tire that is to be shortened or welded is placed between the pairs of jaws. One pair of the jaws is secured to the base support, while the other is applied to a movable block at the upper end of a strong guided lever that is keyed to a pivot-shaft at the lower end. The lever receives a forward motion by a large cog-wheel, which engages a pinion of the pivot-shaft of the lever, the cog-wheel being turned by a pinion of a crank-wheel. By turning the crank-wheel, the movable block and jaws approach the fixed jaws, so as to shorten the tire at the heated part, or weld the ends together, as desired. As the base block forms a kind of anvil-like support for the tire, the shortening or welding process can be assisted and finished by the hammer.

IMPROVED STEAM PUMP.

AMONG the exhibits of Messrs. Hathorn, Davis & Davey, of Leeds, at the Paris Exhibition, is the new form of differential steam pump (Davey's patent) which we illustrate below.

The principle of Mr. Davey's gear is, as will be remembered, that the slide valve derives its motion both from the main crosshead and from a rod connected with a cataract piston moving with a uniform velocity, the two motions being so connected that the cut-off depends upon the velocity of motion of the main cross-head—in other words, upon the resistance encountered or work to be done by the piston. In the differential pumping engine the cataract piston is connected with a subsidiary steam piston working in a separate cylinder fitted with a small slide valve. The principal simplification adopted in the new form of pump is the making of this subsidiary piston (two being now used) in one with the main slide valve, its cylinder being a part of the slide valve chest, on the side of which the auxiliary slide valve works.

The whole arrangement is shown clearly in our engraving. The slide valve (a common D) is placed above the cylinder, and in one piece with it are two pistons (one at each end) working in cylindrical prolongations of the valve box. The outer ends of these cylindrical chambers are connected by ports with a small valve chest, placed beside the other, in which works a small D valve. The main valve is connected by a link to the upper end of the working lever (its stroke being adjustable by varying the position of the connecting pin in the slot shown); a pin a few inches lower down the lever is fixed to the crosshead of a cataract piston, and guided in a straight line, while the lower end of the lever is connected to an arm on the main piston and pump rod. The subsidiary valve is worked from the lever by the button and stop arrangement shown. The action of the gear is easily understood: The auxiliary valve being opened by the stop at the end of the stroke, admits steam behind one of the pistons and connects the other with the exhaust, this steam opens the main valve and keeps it moving forward at a rate determined by the cataract piston, which, of course, commences to move at the same time as the main slide. Steam is thus admitted to the main piston, and the lower end of the working lever commences to move with it, the tendency of its motion being to *close* the valve. Cut-off then takes place, as in the differential pumping engine, at a point determined by the rate at which the closing motion of the crosshead overtakes the opening motion given by the steam acting directly on the main slide.



THE PARIS EXHIBITION—DAVEY'S DIFFERENTIAL PUMP.

The automatic control which this gear exercises over the motion of the pump, is as perfect as in the differential pumping engine, even extending, like it, to the case of total removal of the load from one side of the piston by any accident. The full speed of the pump is 120 feet per minute, but it can work, as we have ourselves seen, quite steadily at two or three strokes per minute if required.

The pump has a diameter of 8 inches, and a stroke of 2 feet, the diameter of the steam cylinder being 12 inches. The maximum delivery is 250 gallons per minute. The pump valves are India-rubber disks, which the makers use for heads up to 150 feet, above that employing single or double beat valves with leather beats. The workmanship of the pump is thoroughly good, and we understand it is made at a price but little above that of the ordinary direct-acting pumps without any controlling or expansive arrangements.—*Engineering*.

PROGRESS AND PROSPECTS OF NEW YORK.

THE *Herald* is confident that New York City stands at the beginning of an unexampled career of prosperity, and needs only fair management and the exercise of common skill and prudence to begin very soon a growth more rapid than anything it has known hitherto in all its history. During the past twenty years "many imprudent speculators have been unfortunate; the city has been shamefully robbed by rings and is very heavily taxed; a multitude of superfluous business men have met with bankruptcy and ruin; but the city has continued to grow. Its commercial supremacy remains; its industrial wealth has increased; it is richer to-day, counting in gold, than it ever was in inflated greenbacks. The valuation of real property, which is this year, on substantially a gold basis, over nine hundred millions, was in 1860, also on a gold basis, only three hundred and ninety-eight and a half millions. That marks the real measure of our growth in the last eighteen years."

For the future the prospects are most promising.

"In the first place the commerce of New York is so immensely greater than that of all its so-called rivals that rivalry is in fact out of the question. Not only are we far ahead of all the principal Atlantic seaports together, but our exports and imports more nearly balance each other than those of Philadelphia and Baltimore, which is an extremely important advantage in cheapening both inland and sea transportation to and from this port, because it means that our transactions are of such a nature that they insure freights for cars and ships both ways, and thus enable carriers to work profitably at lower rates than they can afford in the two other ports we have named.

"With so great a preponderance secured it is evident that we must be the earliest to feel sensibly the stimulus of increased production and exchange and revived industry in the country. Of that increase, so far as it falls to the four seaports, we are reasonably certain to receive in the proportion of more than three to one for the other three cities. If the commerce of the four great ports should double in the next ten years, which is not an impossible supposition, that of New York would reach more than $1,300,000,000; that of the other three combined would only reach a little over $400,000,000."

Add to this the steady improvement of our railway connections; the fact that rents and prices in the city are once more low and reasonable; that rapid transit is already tending to stop the drain on our population, by making it possible for wage earners to secure cheap and healthful homes within the city limits; that we now have a settled financial policy for the city, while the plundering and waste of rings have been stopped—and we have a few of the more cogent reasons for believing that the metropolis of the country is in a far better way for maintaining and increasing its commercial supremacy than it has ever been before.

ONE SOLUTION OF THE LABOR PROBLEM.

IN his evidence before the Labor Committee the head of a large manufacturing firm in this city testified that it was the rule of the firm to employ only temperate people in the numerous establishments they controlled. Five manufacturing towns had grown up around their works in New England and in the Middle States and in the South; and in every instance they presented thrifty and contented communities. There had been no strikes, no quarrels between workmen and employers, and no severe distress even in the hardest of hard times. In the selection of work people the capable and temperate alone were chosen, and thrift followed as a natural consequence.

We are confident that scores of such communities can be found clustered about any well ordered manufacturing establishments, the masters of which take pains to weed out the thriftless and incompetent, while surrounding themselves with those of sterling worth—the steady, the temperate, the trustworthy.

THE remains of a prehistoric village on piles have been discovered in the Barmsee (a small lake in the Bavarian mountains), much like the Swiss lake dwellers' habitations.

THE PARIS EXHIBITION PRIZES.

THE following is a list of the official awards in the American Department for the Paris Exhibition of 1878:

GRAND PRIZES.

American Society of Civil Engineers, models, plans, and photographs.
Bergner & Engle, Philadelphia, lager beer in casks.
Edison, Thomas A., Menlo Park, N. J., phonograph, telephone, electric pen.
Gray, Elisha, Chicago, Ill., multiple acoustic telegraph, musical telegraph, etc.
McCormick, C. H., Chicago, Ill., mowing, reaping, and binding machines.
Memphis Cotton Exchange, bale of Tennessee cotton.
Tiffany & Co., New York city, art work in silver and other metals.
Wheeler & Wilson Manufacturing Company, Connecticut and New York, straight needle sewing machines.
Wheelock, Jerome, Worcester, Mass., steam engine, with improved variable cut-off.

GOLD MEDALS.

Abendroth Brothers, New York city, stoves, ranges, and heating apparatus.
American Watch Company, Waltham, Mass., watches and watch movements.
Anheuser, E. & Co., Brewing Company, St. Louis, Mo., lager beer.
Appleton, D. & Co., New York city, educational and miscellaneous books.
Baker, Walter & Co., Boston, Mass., chocolate and cocoa.
Barnard, Henry, Hartford, Conn., "American Journal of Education."
Barnum, Richardson & Co., Lime Rock, Conn., Salisbury iron ores, pig iron, car wheels, etc.
Bechtel, George, Stapleton, S. I., N. Y., lager beer.
Best, Philip, Brewing Company, Milwaukee, Wis., lager beer bottled for export.
Bidwell, John, Chico, Cal., wheat weighing sixty-eight pounds per bushel.
Bigelow Carpet Company, Clinton, Mass., moquette carpeting.
Bliss & Williams, Brooklyn, N. Y., presses, dies, and machines for making tinware.
Boos, F. & Bro., New York city, American furs and fur clothing.
Brown, Hinman & Co., Columbus, Ohio, agricultural implements.
Brewster & Co., New York city, pleasure carriages, park drag, and a racing sulky.
Brown & Sharpe, Providence, R. I., machine tools.
Burnham & Morrill, Portland, Me., canned meats, salmon, lobsters, corn, etc.
Burt, E. C., New York city, ladies' boots and shoes.
Case, J. I. & Co., Racine, Wis., harvesting, thrashing, and cleaning machines.
Collins & Co., Hartford, Conn., gang plows, axes, hoes, edge tools.
Crane Brothers, Westfield, Mass., paper and paper goods.
Dedrich, P. K. & Co., Albany, N. Y., hay press, horse power, bale tie machine.
Deere & Co., Moline, Ill., plows, gang and sulky.
De Gas, Rene, New Orleans, La., cotton.
Dixon, Joseph, Crucible Company, Jersey City, N. J., lumber pencils, artists' and common pencils.
Dixon, Joseph, Crucible Company, Jersey City, N. J., lubricating plumbago, carburet of iron, stove polish, etc.
Fairbanks, E. & T. & Co., St. Johnsbury, Vt., scales and weighing machines.
Fairbanks, E. & T. & Co., St. Johnsbury, Vt., scales for weighing cattle, etc.
Fairchild, Le Roy W. & Co., New York, gold pens, gold and silver pencil cases, etc.
Farmers' Friend Manufacturing Company, Dayton, Ohio, grain drills.
Fay, J. A. & Co., Cincinnati, Ohio, wood working machinery.
Gale Manufacturing Company, Albion, Mich., hay rake and chilled iron plows.
Glen Cove Starch Manufacturing Company, Glen Cove, N. Y., starch and maizena.
Globe Horseshoe Nail Company, Boston, horseshoe nails, made from cold rolled iron.
Goodyear, Henry B., New York city, machines for making boots and shoes.
Gossamer Rubber Clothing Company, Boston, Mass., rubber clothing, water and heat proof.
Guyot, Arnold, Trenton, N. J., geographies.
Hancock Inspirator Company, Boston, improved injector for feeding water to boilers.
Harper & Brothers, New York city, miscellaneous books and periodicals.
Harvard University, Cambridge, Mass., reports, catalogues, etc.
Herring & Co., New York city, fire and burglar proof safes.
Holyoke Paper Company, Holyoke, Mass., linen, writing, and bank note paper.
Hoopes Brothers & Darlington, West Chester, Pa., wheels, spokes, hubs, fellies, etc.
Hoopes & Townsend, Philadelphia, bolts, rivets, and cold punched nuts.
Howe Scale Company, Rutland, Vt., improved scales and weighing machines.
Hurlburt Paper Company, South Lee, Mass., lithographic and chromo paper, Bristol board.
Johnston Harvester Company, Brockport, N. Y., mowers, reapers, and grain binder.
Jones, Owen, Philadelphia, Pa., automatic shell extracting revolvers.
Lalance & Grosjean Manufacturing Company, New York city, culinary utensils.
Larrabee, E. J. & Co., Albany, N. Y., plain and fancy biscuits and cakes.
Libby, McNeal & Libby, Chicago, Ill., cooked meats.
Lippincott, J. B. & Co., Philadelphia, Pa., text books.
McCormick, Richard C., educational collective exhibit.
McMurray, Louis & Co., Baltimore, Md., oysters in cans.
Maillard, Henry, New York city, chocolate and confectionery.
Mallory, Wheeler & Co., New Haven, Conn., reversible door locks and wrought iron padlocks.
Marcotte, L. & Co., New York city, furniture.
Mason & Hamlin Organ Company, New York city, cabinet organs.
Morris, E. & Co., Philadelphia, felt and silk hats.
Moore, E. C., collaborator, Tiffany & Co.
Murphy's, William F. & Sons, Philadelphia, Pa., blank books.
Nashua Manufacturing Company, Nashua, N. H., unbleached or gray cotton cloths and flannels.
Naval Academy, United States, Annapolis, Md., publications, catalogues, and views.
New York Consolidated Card Company, New York city, playing cards.
Ohio State Department of Public Instruction, Columbus, reports and documents.
Oregon State Commission, Portland. Agricultural.
Osborne, D. M., Manufacturing Company, Auburn, N. Y., mowing and reaping machines.
Pease, F. S., Buffalo, N. Y., illuminating and lubricating oils.
Philadelphia and Reading Coal and Iron Company, American anthracite coal.
Phœnix Card and Paper Company, New York city, printers' cards.
Pratt, Whitney & Co., Hartford, Conn, the Gardner machine gun.
Providence Tool Company, Providence, R. I., breech-loading military and sporting rifles.
Public Library, Boston, Mass, samples of binding.
Reed, John Van D., New York city, canvas hose and circular loom.
Remington, E. & Sons, Ilion, N. Y., breech-loading fire arms ammunition.
Remington, E. & Sons, Ilion, N. Y., military breech-loading and magazine rifles.
Reynolds, A. J., Chicago, Ill., fruit evaporating machine and evaporated fruit.
Richardson & Robbins, Dover, Del., canned tongue, game, meats and preserved fruits.
Russell & Erwin Manufacturing Company, New Britain, Conn., locksmiths' work.
St. Louis Stamping Company, St. Louis, Mo., granite iron ware for household use.
Sarony, Napoleon, New York city, photographic and crayon portraits and sketches.
Shufeldt, H. G., Chicago, Ill., whisky, grain used in manufacture of alcoholic spirits.
Sloan, Thomas J., New York city, automatic machine for making wood screws.
Spencer, Charles A., Geneva, N. Y., microscopic lenses.
Stephenson, John & Co., New York city, three street railway cars.
Striedinger & Doerflinger, Brooklyn, N. Y., model of blasting apparatus used at Hell Gate, New York.
Swinton, William, Cambridge, Mass., series of school books.
Thurber, H. K. & F. B. & Co., New York city, edible cottonseed oil.
Thurber, H. K. & F. B. & Co., New York city, cereals in grain and flour.
Thurber, H. K. & F. B. & Co., wax and honey.
Tiffany & Co., New York city, art work in silver and other metals.
Type Writer Company, New York city, type writers.
United States Department of Agriculture, Washington, D. C.
Wamsutta Mills, New Bedford, Mass., bleached and brown shirtings, cambrics, etc.
Warder, Mitchell & Co., Springfield, Ohio, mowing and reaping machines.
Westinghouse Air Brake Company, Pittsburg, Pa., automatic air brakes for railroad cars.
Weston, Byron, Dalton, Mass., record and account book papers.
Wharton, Joseph, Philadelphia, Pa., nickel and cobalt ores and products.
White, Samuel S., Philadelphia, porcelain teeth, dental instruments, and chairs, foils, etc.
Whiting Paper Company, Holyoke, Mass., fine papers.
Wilcox, W. J. & Co., New York city, refined lard.
Wilson, D. H. & Co., New York city, woodenware and housefurnishing goods.
Wilson Packing Company, Chicago, Ill., canned meats.
Wood, Walter A., Hoosick Falls, N. Y., agricultural machines.
Wood, William Anson, Albany, N. Y., mowing and reaping machine.
Woodward & Dwight, St. Louis, Mo., flour.
Yale Lock Company, Stamford, Conn., Postoffice, time, and bank locks.

SILVER MEDALS.

Adams & Westlake, Chicago, Ill., petroleum stoves.
Adriance, Platt & Co., New York city, agricultural implements.
Aiken, Lambert & Co., New York city, gold pens, cases, pencils, horse timers.
Albert, Charles F., Philadelphia, Pa., violins and violoncellos.
Allen, J. F. & Co., Richmond, Va., tobacco in all forms.
Allen & Roeder, New York city, pneumatic riveting machinery.
American Sewing Machine Company, Philadelphia, sewing machines.
American Grape Sugar Company, Buffalo, N. Y., sugar and sirup from grapes.
Appleton Company, Lowell, Mass., unbleached and gray cotton cloth.
Appleton, D. & Co., New York city, text books.
Archer, Samuel.
Aultman, C. & Co., Canton, Ohio, agricultural machines.
Baeder, Adamson & Co., Philadelphia, Pa., glue, emery, sand paper, hair, moss, etc.
Baker, H. J. & Bro., New York city, castor oil, borax, refined saltpeter, camphor, etc.
Barnes, A. S. & Co., New York city, miscellaneous books.
Bausch & Lomb Optical Company, New York city, optical instruments, eye glasses, magnifiers.
Bay State Rake Company, Winchendon, Mass., horse hay rake.
Bell, Alexander Graham, Boston, Mass., system of visible speech.
Bien, Julius, New York city, geographical, geological, and astronomical maps.
Bien, Julius, New York city, lithography and typography.
Blabon, George W. & Co., Philadelphia, Pa., oilcloths of all kinds and for all purposes.
Blake Crusher Company, New Haven, Conn., working model of Blake's patent stone and ore crusher.
Booth, W., Portland, Oregon, canned salmon.
Bower, B. P., Cleveland, Ohio, Bower's sewer gas trap.
Brill, J. G., Philadelphia, Pa., street railway car.
Brown Caloric Engine Company, New York city, improved caloric engine.
Bruce, George, Son & Co., New York city, specimen book of printing types.
Burnham & Morrill, Portland, Me., canned meats, salmon, lobsters, clams, corn, etc.
Carr, James, New York city, pottery and Parian ware.
Carter, Dinsmore & Co., New York city, writing and copying inks, and mucilage.
Centennial Photograph Company, Philadelphia, Pa., photographs of the Centennial Exhibition, 1876.
Chaffanjon, C., Hudson City, N. J., silk serges, satins, and dress silks.
Chesebrough Manufacturing Company, New York city, vaseline.
Crane & Co., Dalton, Mass., paper stock and bond papers.
Crawford, I. & Co., Chase's Lake, N. Y., hemlock bark and extract.
Clapp, B. P. & Co., Pawtucket, R. I., woods, and their products, obtained from them by dry distillation.
Clausen, H. & Son, New York city, bottled beer.
Clough & Warren Organ Company, Detroit, Mich., cabinet reed organs.
Clough & Williamson, Newark, N. J., steel wire screws, machines for making.
Coates, A. W. & Co., Alliance, Ohio, hay and grain rake, lock lever.
Collender, H. W., New York city, billiard table, with markers, cue racks, etc.
Cook, J. & Co., Portland, Oregon, canned salmon.
Cowperthwait & Co., Philadelphia, Pa., series of text books.
Darling, Brown & Sharpe, Providence, instruments of precision.
Davis, George E., Saccarappa, Me., leather boards for boot and shoe makers' use.
De Lamater, C. H. & Co. New York city, power shearing and punching machines.
Devens, Henry, Brattleboro, Vt., automatic screw making machine.
Dolge, Alfred, New York city, piano felts and sounding boards.
Doty, H. H., Washington, D. C., lamp for lighthouses.
Dougherty, Andrew, New York city, playing cards.
Douglass Ax Manufacturing Company, Boston, axes, hatchets, etc.
Dunbar, G. W. & Sons, New Orleans, La., canned goods, sirups in cans.
Dunnell Manufacturing Company, Pawtucket, R. I., printed calicoes.
Eclipse Windmill (A. J. Corcoran), New York, improved solid wheel, self-regulating windmill.
Erie Preserving Company, Buffalo and New York, canned goods.
Fairbanks, E. & T. & Co., St. Johnsbury, Vt., scales.
Farquhar, A. B., York, Pa., thrashing machine and horse power.
Ficklen, J. B. & Co., Fredericksburg, Va., flour, corn and corn meal, wheat and maize.
Fiegenspan & Co., New York city, lager beer.
Field, A. & Sons, Taunton, Mass., tacks, nails, etc.
Fletcher Manufacturing Company, Providence, R. I., shoe strings, kerosene, lamp and stove wicks.
Gatling Gun Company, Hartford, Conn., Gatling guns.
Gibson's, John, Sons & Co., Pittsburg, Pa., whisky.
Goodyear, Henry B., New York city, machines for making boots and shoes.
Greene, S. H. & Sons, Riverpoint Post Office, R. I., calicoes, handkerchiefs, etc.
Gregg, William L., Philadelphia, brick making machine (triple pressure) and specimen bricks.
Grocers' Packing Company, Boston, Mass., canned salt fish.
Grocers' Packing Company, Boston, Mass., canned vegetables.
Grosvenor, William H., Jr., Providence, R. I., cotton goods.
Gutekunst, F., Philadelphia, artistic photographic pictures.
Hake, Ph., New York, cards for printers and engravers.
Hale & Parshall, Lyons, N. Y., essential oils, peppermint, wintergreen, etc.
Hardrich, H. G. & Sons, Philadelphia, harness and saddlery in general, and harness oil.
Hammond, collaborator.
Harper & Brothers, New York city, charts, books and maps.
Heim, Anton, New York city, leather belting.
Henis, Charles F., Philadelphia, adjustable lock elbow for stove, heater and conductor pipes.
Hotchkiss, H. G., Lyons, N. Y., essential oils.
Hotchkiss, L. B., Phelps, Ontario county, N. Y., essential oils.
Houghton, H. O. & Co., Riverside Press, printers, Cambridge, Mass., miscellaneous books.
Houghton, Osgood & Co., Boston, Mass., books and periodicals.
Howe Scale Company, Rutland, Vt., improved scales and weighing machines.
Howe Scale Company, Rutland, Vt., cattle scales.
Hoyt, J. B. & Co., New York city, machine belting.
Iden & Co., New York city, chandeliers and gas fixtures.
Ivison, Blakeman, Taylor & Co., New York, text books and charts.
Jacobs, S. W. & Son, Philadelphia, two carriages.
Jamison, S. W., Boot and Shoe Crimping Machine Co., New York city, machines for crimping leather.
Jenkins, E. C. & Co., Louisville, Ky., leaf tobacco.
Jenkins, F. W. & Bro., New York city, flour.
Kimball, William S. & Co., Rochester, N. Y., tobacco and cigarettes.
Knight, Edward H., Bellefontaine, Ohio, Knight's American Mechanical Dictionary, 3 vols.
Knight, Harold E., Zanesfield, Ohio, maple sugar.
Kuntz, J. & S. F., Morrisania, N. Y., lager beer.
Kansas State Department Public Instruction, reports and scholars' work.
La France Manufacturing Company, Elmira, N. Y., rotary steamer fire engine and horse cart.
Landy, James, Cincinnati, Ohio, photographs.
Lea, Henry C., Philadelphia, Pa., medical text books, 37 vols.
Leaming, J. S., Wilmington, Ohio, corn.
Leeds, L. W. & Co., New York city, diagrams illustrating method of ventilating and warming buildings.
Leigh, Edwin, Brooklyn, N. Y., appliances for teaching.
Lemp, W. J., St. Louis, Mo., bottled beer.
Lincoln, D. F., Boston, Mass., reports and papers.
Lobdell Car Wheel Company, Wilmington, Del. (three silver medals), cast chilled iron car wheels, and cast chilled iron rolls for calendering paper.
Macatee & Bro., Front Royal, Va., sumac, in various stages of manufacture.
McFarlane, V. W. & Co., New York city, refined lard.
MacKellar, Smiths & Jordan, Philadelphia, specimen book of printing types, etc.
Manville Company, Providence, R. I., cambric linings.

Monticello Wine Company, Charlottesville, Va., wines.
Morse Twist Drill and Machine Company, New Bedford, Mass., twist drill and other machinists' tools.
National Rubber Company, Bristol, R. I., rubber goods.
New Haven Wheel Company, New Haven, Conn., carriage, cart, wagon, and truck wheels, and wheel materials of American woods, for home use and for export.
Northampton Emery Wheel Company, Leeds, Mass., patent solid emery wheels and emery wheel machinery.
Open Stove Ventilating Company, New York city, factory, Phillipsburg, N. J.
Osborne, C. S. & Co., Newark, N. J., saddlers' and harness makers' tools.
Outcalt, J., Spottswood, N. J., corn meal and hominy.
Perry, F. H., Providence, R. I., preserved fruits.
Phelps, W. F., Whitewater, Wis., "Handbook for Teachers," one vol.
Philadelphia College of Pharmacy, Philadelphia, collection of American drugs.
Philadelphia and Reading Railroad Company, Philadelphia, American locomotive.
Prang, L. & Co., Boston, Mass., books, chromos and lithographs.
Providence Steam Mills, Providence, R. I., bleached cotton goods.
Providence Tool Company, Providence, R. I., firearms.
Pullman Palace Car Company, Chicago, Ill., one model palace sleeping car, one full-sized palace sleeping car.
Rathbone, Sard & Co., Albany, N. Y., stoves and ranges.
Richards, Charles B., Hartford, Conn., indicator for steam engines.
Ritchie, E. S. & Sons, Boston, Mass., physical apparatus for higher elementary schools.
Rubber Cushioned Axle Company, New York city, axles and wheels.
St. Louis Beef Canning Company, St. Louis, Mo., canned meats.
Schieffelin, W. H. & Co., New York city, soluble coated pills.
Schumacher, Ferdinand, Akron, Ohio, various products from cereals.
Scribner, Armstrong & Co., New York city, text books.
Sharp's Rifle Company, Bridgeport, Conn., breech-loading military and sporting rifles.
Shawmut Manufacturing Company, Boston, Mass., leatherette, imitation of paper.
Slater Cotton Company, Providence, R. I., bleached sheetings.
Smith, German, Winchester, Va., sumac (leaf and ground), quercitron bark.
Smith, Joshua, Chicago, Ill., photographs.
Smith, Walter, Boston, Mass., publications and appliances relating to industrial art.
Sollers, S. D. & Co., Philadelphia, Pa., children's and infants' shoes and slippers.
Speer, Alexander & Sons, Pittsburg, Pa., plows and cultivators.
Stetson, John B., Philadelphia, soft and stiff, fur, felt hats.
Stieff, Charles M., Baltimore, Md., upright, grand pianos.
Stow Flexible Shaft Company, Philadelphia, flexible shafts with drill presses.
Stratton & Cullum, Meadville, Pa., hay loader.
Thomas (Seth) Clock Company, New York city, tower, church, house and marine clocks.
Thompson & Brown, Boston, Mass., Eaton and Bradbury's series of mathematics.
Tilt, B. B. & Son, Paterson, N. J., Jacquard power silk loom.
Tobin, Joseph F., New York city, manufactured whalebone.
Trigg, George P., New York city, boneless codfish.
Trowbridge, W. H., Danville, Va., smoking tobacco.
Union Metallic Cartridge Company, Bridgeport, Conn., cartridges (metallic).
United States Windmill, Engine and Pump Company, Batavia, Ill., windmills.
Valentine & Co., New York city, varnishes.
Van Antwerp, Bragg & Co., Cincinnati, Ohio, text books.
Wallace Brothers, Statesville, N. C., medicinal plants, herbs, flowers, etc.
Wallace, Shippen, Philadelphia, Pa., oil of cedar.
Wauregan Mills, Providence, R. I., brown and bleached cotton goods.
Welsh & Lea, Philadelphia, Pa., bolts and nuts for vehicles.
Whitman, Stephen F., Philadelphia, Pa., chocolate and confections.
Whitney, A. & Sons, Philadelphia, car wheels.
Wickersham, J. P., Lancaster, Pa., set of Pennsylvania School journal.
Williams, David, New York city, files of the *Iron Age*, *Metal Worker*.
Willimantic Linen Company, Hartford, Conn., spool cotton.
Yale Lock Company, Stamford, Conn., section of Post Office locks, bronze hardware, time and bank locks.
Young, D. M. & Co., Boston, Mass., extract of bark.
Young, J. S. & Co., Hanover, Pa., quercitron bark, bolted, ground and extract.
Zentmayer, Joseph, Philadelphia, microscope, with accessories.

BRONZE MEDALS.

Abbey, Charles & Sons, Philadelphia, Pa., dentists' fine gold foil.
Aiken & Drummond, Louisville, Ky., moulding machine for foundries.
Allen, John & Sons, New York city, artificial dentures.
Allendale Company, Providence, R.I., cotton sheetings, etc., bleached sheetings.
American Printing House for the Blind, Louisville, Ky., raised and dissected map of the United States, etc.
American Wine Company, St. Louis, Mo., champagne.
Ames, Oliver & Sons, North Easton, Mass., shovels, spades, etc.
Andrews, A. H. & Co., Chicago, Ill., school desk, noiseless slates and other apparatus.
Ansonia Clock Company, Ansonia, Conn., clocks and movements.
Asher & Adams, New York city, map of the United States and pictorial album.
Anderson, J. J., New York, histories.
Auburn Manufacturing Company, Auburn, N. Y., agricultural hand implements, as forks, hoes, etc.
Baeder, Adamson & Co., Philadelphia, Pa., glue, emery, sand paper, hair, moss, etc.
Bailey, Leonard & Co., Hartford, Conn., adjustable iron bench planes and try squares.
Barnes, A. S. & Co., New York city, text books for elementary and secondary instruction.
Batcheller & Sons, Wallingford, Vt., agricultural forks.
Benkert, C. & Son, Philadelphia, Pa., boots, shoes, &c.
Bickford & Hoffman, Macedon, N. Y., seed drills, for sowing and measuring all kinds of grain and grass seeds.
Bergner, Theodore, Philadelphia, Pa., wire floor for malt kilns.
Bicknell, T. W., Boston, Mass., national and New England journals of education.
Bienville Oil Works Company, New Orleans, La., products from cotton seed.
Blatchley, C. G., Philadelphia, Pa., ice cream freezers.
Bolen & Byrne, New York city, mineral waters and apparatus.
Bower, Henry, Philadelphia, Pa., glycerine and sulphate of ammonia.
Brooks, Ezra, Hartford, Conn., "Hartford" automatic pumps, worked by wind power or by steam.
Brown, A. & F., New York city, siren, with fog trumpet attached.
Brown, B. F., Boston, Mass., blacking.
Brown, Hinman & Co., Columbus, Ohio, garden and farming tools.
Bush, Isidor, & Co., St. Louis, Mo., wines.
Campbell, Hall & Co., New York city, national safety paper for checks, etc.
Case Brothers, South Manchester, Conn., press boards for printers' use.
Clark & Maynard, New York city, Anderson's school histories and various other text books.
Clark, E. B., Middlefield, Conn., agricultural products.
Closser, J. A. & Co., Indianapolis, Ind., millet seed, corn, wheat.
Colt's Patent Fire Arms Company, Hartford, Conn., guns and pistols.
Cortland Wagon Manufacturing Company, Cortland, New York city, platform spring wagons, for pleasure or business.
Crane Brothers Manufacturing Company, Chicago, Ill., malleable iron fittings and brass valves, cocks.
Cummings & Lockwood, New York city, curled hair, neat's-foot oil, bones, etc.
Daughaday, J. W. & Co., Philadelphia, Pa., job printing presses, hand and foot power.
Davis, John G. & Son, Philadelphia, Pa., wheel stock, spokes, rims, and plow handles.
Davis, William J., Philadelphia, Pa., reliance anchor, non-fouling and self-canting.
Demorest, Mr. and Mrs. Jennings, New York city, fashion plates and dress models.
Dimes, New York, collaborator of Tiffany & Co.
Douglass Ax Manufacturing Company, Boston, axes, hatchets, etc.
Dixon, Joseph, Crucible Company, Jersey City, N. J., lumber pencils.
Doremus, Peter C., New York city, automatic sofa spring bed and lounge, industrial, B. 1, class 17.
Dorman Manufacturing Company, New York city, ja-se-po-ri ware, bamboo.
Douglas, W. & B., Middletown, Conn., pumps of all descriptions.
Drydopple, William, Philadelphia, Pa., borax soap.
Dunnell Manufacturing Company, Pawtucket, R. I., printed calicoes.
Fairbanks, E. & T. & Co., St. Johnsbury, Vt., railway track scales.
Fall Mountain Paper Company, Bellows Falls, Vt., news, printing, and double manila papers.
Flanders, L. B., Philadelphia, Pa., rotary valve-seat planing machine.
Fletcher Manufacturing Company, Providence, R. I., shoestrings, kerosene, lamp, and stove wicks.
Forestdale Manufacturing Company, Slatersville, R. I., bleached cotton goods.
Freeland, Robert, South Boston, Mass., laundry, toilet, and manufacturers' soap.
Fritzsche Brothers, New York city, essential oils.
Funck, Joseph, Staten Island, N. Y., lamps for lighthouse and domestic use.
Gale Manufacturing Company, Albion, Mich., hay rake and chilled iron plow.
Gally, Merritt, New York city, power printing and embossing presses.
Gardner & Co., New York city, perforated veneer seats.
Gebbie & Barrie, Philadelphia, books and publications.
Ginn & Heath, Boston, Mass., text books.
Gubbelman, Theo., Jersey City, N. J., photographic portraits.
Gückerheimer & Bros., Pittsburg, Pa., whisky.
Guerin, Fitz W., St. Louis, Mo., photographs from life in imitation of statuary.
Grosjian, New York, collaborator of Tiffany & Co.
Hagstoz & Thorpe, Philadelphia, Pa., watch cases plated with gold.
Hance Brothers & White, Philadelphia, chemical and pharmaceutical preparations.
Hartman, P., New York city, filigree silver jewelry.
Hercules Lever Jack Company, Newark, N. J., Hercules lever jack hand power press.
Heller & Co., collaborators, Tiffany & Co.
Hincke, Julius, Egg Harbor City, N. J., wines.
Holding Mills, Ill.
Hinds, ——, collaborator.
Holt, Henry, & Co., New York city, text books.
Houghton, E. F. & Co., Philadelphia, Pa., cosmoline, or concentrated and purified petroleum.
Howe Scale Company, Rutland, Vt., improved scales and weighing machines.
Hurlburt Paper Company, South Lee, Mass., lithographic and chromo paper, bristol board.
Ives, F., Cambridge, Mass., two buggies.
Johnson, A. J., New York city, general encyclopædia.
Jury, F. Herman, New York city, two folding children's carriages.
Justi, E. D., Philadelphia, Pa., dental instruments and appliances and teeth.
Justice, Philip Syng, Philadelphia, Pa., iron and steel produced from the ores direct.
Killebren, J. B., Nashville, Tenn., agricultural products.
Knapp, J. H., New York city, gold pens, pencils, etc.
Lehnert, Henry G., Philadelphia, brass musical instruments for bands.
Lewis, W. K. & Bro., Boston, Mass., canned and preserved fruits.
Libby, James L., New York city, paper collars and cuffs and cloth faced paper.
Lippincott, J. B. & Co., Philadelphia, Pa., text books for elementary and secondary instruction.
Loewenberg, Henry, Philadelphia, "velociplastic," facsimiles of leather, damasks.
Lorenz Bros., Toledo, Ohio, perfumery and articles for the toilet.
Lovell, John P. & Sons, Boston, Mass., air guns, pistols, and revolvers.
Macatee & Bro., Front Royal, Va., sumac, in various stages of manufacture.
McKenney, E. F. & F. L., Marengo, Ill., preserved fruits.
McKesson & Robbins, New York city, American crude drugs and essential oils.
McPherson, Samuel, Louisville, Ky., leaf tobacco.
McShane, Henry & Co., Baltimore, Md., church bells and mountings.
Markt & Co., New York city, horse rakes, forks, shovels, and hoes, etc.
Mason, A., New York city, machine for making embroidery and braiding.
Mason, Volney W. & Co., Providence, R. I., friction clutch pulleys.
Massey, Wm. C. & Co., Philadelphia, ale and porter.
Matthews, John, New York city, soda water apparatus.
Merriam, G. & C., Springfield, Mass., Webster's dictionaries.
Meyer, Conrad & Sons, Philadelphia, Pa., pianofortes.
Mitchell, Henry, Boston, Mass., medals and seals engraved.
Montague Paper Company, Turners Falls, Mass., news printing paper.
Morris, Wheeler & Co., Philadelphia, sample card, showing cut nails.
Morton, James, New York city, gold pens and pencils.
Munroe, Lewis B., Boston, Mass, system of teaching the first steps of reading.
National Rubber Company, Bristol, R. I., rubber goods.
New England Granite Works, Hartford, Conn., vase of polished "Westerly" granite (two bronze medals).
Newton Paper Company, Holyoke, Mass., carpet lining paper, moth proof.
New York Silicate Book Slate Company, New York city, silicate book slates, liquid slating.
Nonotuck Silk Company, Florence, Mass., spool sewing silk.
Northfield Knife Company, Northfield, Conn., pocket cutlery.
Oakley, Thomas B., Paris, France, works of art in California gold.
Ohio Tool Company, Columbus, Ohio, carpenters' hand tools.
Oregon Furniture Manufacturing Company, Portland, Oregon, desk and a cabinet.
Ott & Brewer, Trenton, N J., white and colored vases, busts.
Packer, Charles W., Philadelphia, paper box manufacturers' machines.
Parker, Joseph & Son, New Haven, Conn., blotting paper.
Pattberg, Lewis & Bro., New York city; factory, Jersey City; velvet and metal picture frames, toilet mirrors.
Peil, W. F. & Co., Indianapolis, Ind., refined corn starch.
Pennsylvania File Works, McCaffrey & Bro., Philadelphia, files and rasps.
Pickering, T. R. & Co., Portland, Conn., steam engine governors, with improved automatic stop motion and speed adjuster. For use of Commission on Engines in United States section.
Pirz, Anthony (Carniola Chemical Works), Long Island City, N. Y., sugar of lead.
Plummer, M., Portland, Oregon, dried fruits and vegetables.
Poeschel & Scherer, Hermann, Mo., wines.
Porter & Mowbray, Winona, Minn., flour.
Pretty, Grime & Co., Philadelphia, Pa., gray and mourning prints.
Pringle, C. G., Charlotte, Vt., woods and barks.
Publishers' Weekly (F. Leypoldt), New York city, Book Trade Journal, bibliographical publications.
Randolph, Theodore F., Morristown, N. J., ditching machine.
Rauchfuss, G., New York city, wigs, toupees, and hair work.
Raynald, John, Philadelphia, Pa., black ink.
Reynolds, A. J., Chicago, Ill., fruit evaporating machine and evaporated fruit.
Richardson, D. M., Detroit, Mich., wheat polisher and separator.
Rogers, C. B., Philadelphia, Pa., diamond wheat.
Ross, Joseph L., Boston, Mass., school desks.
Russell & Erwin Manufacturing Company, New Britain, Conn., hardware, two bronze medals.
Reuter & Alley, Boston, Mass., ales.
Sabin, J. & Sons, New York city, Dictionary of American books, A—H, nine volumes.
Sachse, F. & Son, Philadelphia, Pa., shirts.
Sadlier, W. H., New York city, text books for elementary instruction.
Schepp, Leopold, New York city, desiccated cocoanut.
Scholl, Bruno, Chicago, engraving on pine wood for theatrical advertising.
Schultz, Southwick & Co., New York city, sole leather.
Scott, T. Seymour & Bro., Philadelphia, flour sack and building paper.
Scribner, Armstrong & Co., New York city. 1. Text books for elementary and secondary instruction; 27 volumes. 2. Set of drawing cards; miscellaneous books, maps.
Scribner & Co., New York city, periodicals.
Seabury & Johnson, New York city, Pharmacopœia, medicinal and surgical plasters.
Seavey, Lafayette W., New York city, photographs illustrating photographic backgrounds and accessories.
Seefeldt, William F., Philadelphia, Pa., band instruments.
Seidle, F., Mechanicsburg, Pa., finished wheels, spokes, hubs, fellies, shafts, and poles.
Semple, Samuel & Sons, Mount Holly, N. J., spool cotton.
Seward, M. & Son, New Haven, Conn., carriage hardware.
Sboninger, B., Piano and Organ Company, New Haven, Conn., pianos and organs.
Shriver & Co., New York city, presses for copying letters.
Slater, John F., Jewett City, Conn., cheviot shirtings.
Slote, Woodman & Co., New York city, blank and scrap books.
Sower, Potts & Co., Philadelphia, Pa., text books for elementary instructions.
Stanley Rule and Level Company, New Britain, Conn., carpenters' tools.
Stearns, John N. & Co., New York city, manufactured silk.
Steiger, E., New York city, Encyclopædia of Education, two bronze medals.
Stephens Patent Vise Company, New York city, vises and attachments, and planer chucks.
Stoddard, John W. & Co., Dayton, Ohio, self operating hay rake, grain drill, and broadcast seeder.
Taylor Manufacturing Company, Westminster, Md., agricultural engines and machines, two bronze medals.
Taylor, Nichols & Co., Springfield, Mass., papeteries.
Thompson, Nathan, Brooklyn, N. Y., universal window, door, and blind fasteners.

(*To be continued.*)

AN IMPRESSIONIST AT THE PARIS EXHIBITION.

THE great moment is when, after an ocean, frontiers, and inexorable Paris landlords, you arrive, disembarrassed of everything, on the inner terrace of the Trocadéro palace. You hold yourself open to the impressions that may naturally be expected to seize upon you. There is a school of "impressionist" painters here, who give, as it were, the first broad flash of anything, immediately turned away from, and not looked back at or reflected about. Flash! some rapid patches of pink, of white, scattering blue, a ground tone of tawny yellow—a young woman with a parasol walking in a wheat field. Let us try that. Flash! a blue sky; four large shining spots, colossal golden animals, close in front. They are a horse, an ox, an elephant, and a rhinoceros, rearing defiantly around a basin of numerous streams, with rainbows in them. The mailed rhinoceros is particularly picturesque. Long bars of orange and the yellow of new oak, on both sides of the river, for pavilions of navigation and railway supplies and the pavilion of forestry; bars of Venetian red above them for their roofs of earthen tiles; pale striped greens for the café of Morocco, the French restaurant on the right, the Spanish—balancing it—on the left; dusty greens for the grass plats, with enameled borders; drab and pink for the Egyptian temple; slate and scarlet for the Chinese pagoda; delicious white amid embowering foliage for the mosque of Algiers, with a bit of the river reflecting the sky behind it. In the distance, the palace of the Champ de Mars extends its sections of glass a little mistily between the strong patches of cream color which are the solid supports of the domes at the ends and in the center. Projecting spires and small points everywhere, indicating a complication of objects hidden in the shrubbery. A staring stone of gravel for the highways and paths, needlessly vast and sterile, as it seems, fills all the central portion. Then, flags of all nations, gay marquees, kiosks of terra cotta, canary of regimented chairs and white of marble-topped tables at the restaurants, scattered into all the interstices, to make up the Joseph's coat of many colors spread upon the astonished ground—this poor ground, when it thinks what a commonplace territory it was so recently!

Around the whole, Paris, a mosaic of gray patches laid one against another, vanishing to the horizon. St. Sulpice, the Pantheon, and Notre Dame rise distantly out of it. The gilded dome of the Invalides—not so imposing as that of the Boston State House—rises nearer, and does not keep its place, but insists upon coming forward, by reason of its holiday attire, and joining the revelry in front.

This may pass for an "impression." An impression is as much as the general view is worth. The interest lies more and more in the details. Conceive that the locality is an oblong strip, of more than a mile, cut by the river. One-quarter of it, sloping rapidly, is on this side. It is crowned by a singular building—to remain—which contains the concert hall for five thousand persons, and museums of retrospective art. I cannot think of a bulky central edifice anywhere else, like an Italian baptistery or the royal Albert Hall, with long curving wings. It is something entirely new. They are really *wings*, bent inward, as if beating the air. A rude diagram shows it better than explanations. It makes too startling a profession of its originality, it seems to me. The sweeping wings are weak, and do not get clutch enough on the ground. There is something disagreeable, too—you get it from the lithographs as well—in the conflict of the curves of the rotunda which rise, as they come out toward you, with the others which fall. The façade first visible on coming down the Avenue Roi de Rome, on which lives the uncomely queen of Spain behind a gilded grating, is really railroad-station-like.

It is a mammoth structure in its scale. Its two yellow campaniles, forty feet higher than Notre Dame, signal to all Paris the merry-making in progress within, and, coming nearer, you find that the profuse ornamentation which seemed to be merely the vacant device of "rustication" is bands of alternate light and dark; that the Palazzo Vecchio campaniles are daintily gilded and have polished marble angle shafts; and that the material in general is of the most expensive. Still, it is not going to be such a reminiscence of the Exhibition of 1878 as was left by that of 1854 in the present Palais de l'Industrie, in which our Philadelphia art gallery found its motive. In its original state the Trocadéro was a park and the Champ de Mars a parade ground, as all the world knows, and the bridge of Jena connects them. It was but a minor feat of the costly enterprise partly to raise the ground and partly sink the level of the streets crossing them, so that the tide of ordinary traffic surges through between high walls that give only such enticing suggestions of the interior as are contained in the bracketed roofs and flying banners showing above.

We have been looking out from the frame of a bay of the carving cloisters, and over the edge of a basin in violent ebullition, which seems to drop, but does not, directly into the basin of the golden beasts below. It is only a matter of going down to find that it reaches it by a series of steps, with plume-like jets spouting beside them, which go to make up the *grandes eaux* at a cost of nearly a million dollars for themselves alone. There are golden figures about this upper basin, too—Europe, Asia, America, gazing massively at the fervid panorama, with their wheat sheaves, their stylets, their wheels of industry, disposed about them. It is a great day for Allegory. I know not to what enormous total the admissions for some one date would rise could her representatives in the grounds be added. They spring lightly from domes; they point this way and that; they suspend wreaths of victory and undying fame. Two splendid bronze geniuses cross hands over the arch of the main portal of the Champ de Mars; two others upon each pier guard the emblazoned shield of a nation, with a long pennant above them. The most singular of all is the section of Bartholdi's Liberty, which is not here a hand, but an enormous head. It is the only thing on a scale with the Exhibition. Casting a far-looking, level glance over the whole from its deep-set eyes, it has in its knitted brows a strangely troubled expression, as though it bore the entire burden of responsibility. One is ready to ask, "Why did you ever try to hold it?"

An allegory with a political significance is the statue of the Republic, in the position of honor on the terrace in front of the industrial palace. The artist has conceived a very mature, substantial republic, a sort of rule-Britannia figure, in a helmet, sitting, and holding a sword. There is nothing to allude to its comparative youth but the virgin newness and whiteness of the material. A Bonapartist caricature represents that it is a crafty republican leader inside of the statue, thinly plastered over. But it is an up-hill task to produce a conviction like that. On the contrary, I see a number of indications every day, an Anglo-Saxon style of things, that makes me think that the republic covers not a few only, but a great number of people, and is likely, this time, to be an institution of permanence.

A row of colossal figures of nations, rough cast in terra cotta—they must be eighteen feet high—against the piers of the façade, has, in spite of their dimensions, a pronounced individual character. You could expect the regal Spain, the stalwart, pensant Norway, the charming Japan, with the texture of the silk sash and gown given even in the bold work, to step down from their pedestals and be really intelligent and amiable.

Is the almost monopoly of woman here, I wonder, anything of an offset to her partial exclusion from the trades and professions? And why is it that allegory has so little use for man in its symbolizations? He has more or less to do, in his way, with the subject matter of them.

It is the habit of exhibitions to have a main building. In it more of their essential character inheres than anywhere else. They are not of extraordinary occurrence now. They are becoming a regular industry, with three of the greatest in five years. What is the progressive sense as to imposing effect? as to the most convenient means of display of the prodigious quantities of goods poured together into their laps? It is not easy to find as yet points of agreement in the more general and important particulars. At Paris, in '67, it was an ellipse, with a central garden that held the main volume of matters; at Vienna, in '73, an interminable nave, with transepts; at Philadelphia, a moderate parallelogram, with three great classes, machinery, agriculture, and art, dismissed to separate edifices; at Paris, at the present time, an enormous parallelogram.

There is not a more pronounced unanimity, as this indeed is closely connected with the form, upon the classification of articles, or upon the precise objects which it is desirable to subserve. Thus at Paris in '67 it was thought useful—and I do not see how there can be more than one opinion on this point—to have a double classification, so that nations could be inspected as a whole, and at the same time whoever was interested in a special line of products might be able to follow it easily from one to the other through them all. To secure this, seven groups of products were distributed in seven concentric corridors, and the nations cut them, according to their requirements of space, in sectors. If you followed a radius, you traversed, say, Spain only. If you followed the sixth corridor, say, you passed from the machinery of Belgium to that of Prussia, then to that of South Germany, then to that of Austria.

At Vienna nothing of this was attempted, nor at Philadelphia, except in special detached buildings. We occupied an end and one-half of the right-hand side, it will be remembered, while foreign nations had strips opening both ways from a fine central aisle 70 feet high and 120 wide, of which they made much for characteristic entrances. On the present occasion it is returned to in good part; an orderly comparative arrangement can be followed in lines through all of the foreign sections, while the same system prevails in the French exhibit, to which, on account of its naturally greater size, one-half of the building is allotted. To traverse any department takes two lengths of the building—little short of a mile in a straight line—one for the French and one for the foreigners; but it can be done. If I should have the laying out of an international exhibition at some time, I think I should propose the flat iron plan, the shape of the New York Post Office. The entertaining nation would occupy the wide portion. The aisles would converge to the small end, where the minor nations would find proper accommodation according to their diminishing exhibits. The ellipse of '67 being deemed unadvisable for repetition, expensive by reason of the endless curvature of all the joinery, unsalable when taken down, and hardly capable of anything more than a huge circus tent effect, I do not see why this would not pretty well meet the requirements. It is cheerfully submitted, without demand for remuneration, to any whom it may concern.

It was the opinion of General Banks, apropos of the moderate appropriation required to give us a representation there, that the classification of '67 was the most sublime category of human products ever drawn out in order. If so it is a commendation that still applies, since the present classification follows very closely that of '67. In the meantime that of Philadelphia appears to me more clear-cut and logical. Seven departments: one for things under the ground, mining and metallurgy; another for those on the surface, agriculture, including the life of the woods and the sea as well; manufactures, the shapes into which the primary materials from these are wrought by human ingenuity; machinery, the apparatus by which it is done; education, the training of the directing intelligence; art, the flower of beauty that comes to solace and give a character of rejoicing to the whole. There it was the earth principally which served as the point of departure. Here it is more directly man: one department for his food, another for clothing, another for furniture. At Vienna this system was developed to twenty-six different groups.

We have in '78 nine groups, while in '67 there were ten. This tenth group was arranged by Napoleon III. with a special view to the working classes. It was for objects "ameliorating the moral and physical condition of populations." It included, among other things, food, clothing, and furniture distinguished for useful qualities, combined with cheapness, and examples of work showing peculiar individualism, such as have most resisted the influence of machinery. An American commissioner thought that the institution of this group alone was sufficient to place the name of the emperor "on the roll of permanent history in letters of light." There is less tenderness for the workingmen at present, and these articles have been distributed under such heads as convenience dictated. Two main groups of agriculture, which consist largely of changing exhibitions of live stock and horticulture, are naturally either out-of-doors or housed in pavilions. Seven in-door groups are to be provided for. It is done by ranging them in parallel sheds (as they may be called without an intention to be derogatory) down the thickly-built parallelogram. The nations cut across their half at right angles, and face upon a central breathing strip, which holds also the continuous pavilions of the fine arts, as well as an individual display of especial elegance by the city of Paris.

They have made a charming place of it, this street of nations, except for its narrowness. One is drawn to many a well-pleased promenade there—issuing out at the hour of closing, and postponing his fatigue to follow, with an enduring interest, the complexity of turrets, arcades, belfries, broken roofs, and gable ends retiring down the fantastic line. Spain has a Moorish façade; Portugal, the luxuriant carvings of Belem; Russia and the Scandinavians, fronts in massive varnished wood; and Belgium, a civic palace, at 600,000 francs, like some of the best of those which ornament the modern streets of that favored country, surprisingly skilled, tasteful, and prosperous in all of its appointments. Switzerland recalls her Genevas and Neufchâtels with an arching belfry, in which a man in armor strikes the hours stiffly with a hammer.

As to the matter of exterior effect in international exhibition main buildings, the first of the two of Paris did not much try for it. The long, low range of Vienna, with its painted plaster decoration, is spoken of as tame; Philadelphia strove for a monumental air as well as it could, pinched by a severe economy. It has been reserved for the present industrial palace to do something really brilliant. It does not strike you as vast—except perhaps from a point up or down the river, where two sides of it can be seen. The whole extent of the space under cover is not visible, because the sheds are surrounded by the high outer galleries, which *are* the palace as far as the spectator is concerned. The matter of vastness is not the thing here, either, as it is with us. It has too much to contend with. What extent could there be to draw more than a moderate astonishment from populations used to the London houses of Parliament and the grandiose, solid court of the Louvre?

It is of iron and glass, and avows itself ephemeral, and the narrow end is that which is principally seen. It throws itself upon the charm of an original design, gay and pleasing color, and above all of valuable materials. You like it better the nearer you approach. You recognize with growing surprise not only that it is not going to be cheap, but that it is impressively expensive. It is a remark that applies to the Exhibition throughout. The panel of decoration on the pilasters, for instance, which seemed to be a stenciled pattern, is found to be a lovely mosaic tiling in high relief. The iron frame is zinc color; the doors are the red of wineles; the interiors of the lofty entrance half-domes, bronze gilt; the windows, traced a little with patterns of blue and amber. It impresses you like a magnified specimen of one of those cheerful tankards in the department of Bohemian glass, which are ornamented with arabesques, mottoes, and touches of gold. There are charming views through the clear glass: either within, at the lapis-lazuli vases and heaped-up treasures, or without, at the profusely landscape-gardened prospect and the moving people. The sky shows through the edifice from a proper distance, and adds to its bluish tint. The clouds pile up behind it at sunset, and once I have seen, in a sultry atmosphere, a yellow moon, the size of a cart-wheel, rise out of the very midst of it, with a ravishing effect.

Though ephemeral, it has a certain seriousness, too. It is not of the bubble-like order. The great frames of glass and most of the other shapes are square-headed. This is sincere, now that I think of it; iron has no need to be arched. Conceive, then, that it stands upon a long terrace—the stately feature of which, with the *quille*, we have not learned yet to make use of in America—with flower beds about it, and palms in blue and white porcelain tubs on the ramps of the steps.

The spectacular aspect of exhibitions is, after as much argument as may be expended, their principal aspect. There is no doubt about the number of things for reflection; but it is not the handful of earnest students pursuing these, inspectors with no language but their own, preparing reports among yawning shop boys retained for police duty, for oblivion in government printing offices, or even parties of personally-conducted British workmen arrived for eight days, for whom they are given. It is for the great five millions, eight millions, ten millions, who come to pay their franc for once or twice, pass through in a daze at the illimitability of things, and take back a description of a swimming doll to their friends in the country. I doubt, too, about those British workmen, whether they are going to give all of the eight days to the strict line of mechanics in which lies their profession in life. Exhibitions are the best of advertising mediums for articles whose points catch the attention easily, and there is no doubt about their containing the best thing of its kind in any particular line. The views they give of foreign lands cannot be relied upon to take the place of actual visits. What you find is too much a matter of hazard. It does not follow that the public instruction of Spain is better than that of England because the latter is represented by but a single, pushing, private boarding school; nor that a country is the strongest as a whole in some respects which may make a remarkable showing from a particular locality.

I would rather take what I could learn of a country, reading its newspapers at breakfast, while taking my coffee, for a week in its capital, than the selected and ticketed facts of a number of exhibitions. There is talk of one at Rome presently. They will no doubt go on, since numerous important powers are still to be heard from. If commerce finds, as it does, its interest in them, there is no reason why they should stop from any considerations of *ennui* and a general resemblance—the main constituency every time. It was the United States that sent most of the ten millions of admissions to Philadelphia, and it will be Italy, Germany, or Russia that will send the necessary millions next to Rome, Berlin, or St. Petersburg, as the case may be.

I am not sure, therefore, that an apology is not demanded for passing by at first the most obvious spectacular attractions, the strange peoples and their hamlets clustered about the grounds. A droning music issues from an Arab café, as though the wake of a mummy might be in progress. An ancient Gaul, in granite, one of four at the angles of the bridge, having dismounted, is reining back his fiery steed, and may have come to attend. But let us plunge in, nevertheless, among the improving contents of the industrial palace.

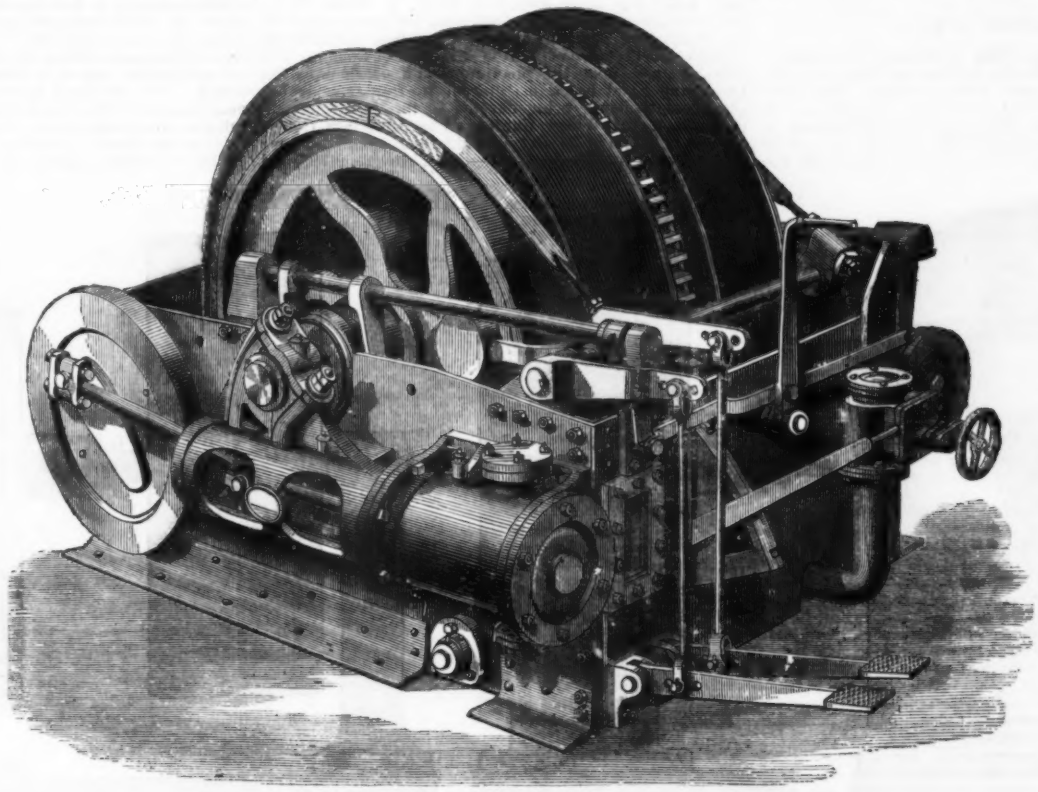
The names of the groups of goods we are to find are over the arches of the interior promenades: fine arts, liberal arts, furniture, raiment, products (primary and manufactured), machinery, aliment. It is so managed that some of the most perfect specimens of each—the Sèvres porcelain; the Gobelin and Beauvais tapestries; Thebaut's trophy of metals, with the splendid Charlemagne on top; the Russian malachites; the treasures brought by the Prince of Wales from India—come out at the ends into the transverse galleries, where they can hold the most brilliant court. The groups are cut up into appropriate classes. To each its jury, ninety in all. They are liberal juries. Three men out of five of the fifty thousand exhibitors will go away with something for their trouble. Little short of thirty thousand medals and diplomas will be hung in various parts of the world, and will serve to convey the impression that each and every spectator paused before the article in question, after a rigid examination of all the others, and unhesitatingly declared, "Yes, it is the best."

These liberal arts include, a little at random it seems, education, photography, stationery, surgical and musical instruments, and the calculating machine, just as you find firearms and traveling apparatus attached to the department of clothing.

To be Continued.

IMPROVED HAULING ENGINE

WE illustrate below a hauling engine which has been specially designed for using compressed air or steam underground. The framing is entirely composed of boiler plate, and however much the foundation may settle, which is a common occurrence underground, the engine, being self-contained, is quite unaffected. The engine is exceedingly compact, and thus avoids unnecessary expense in cutting ground for its reception. The illustration shows a pair of 10 in. cylinders with 3 ft. 6 in. drums. These engines are manufactured by the Uskside Company, of Newport, Mon., who are introducing their engines very successfully into the mining districts.—*Engineering.*



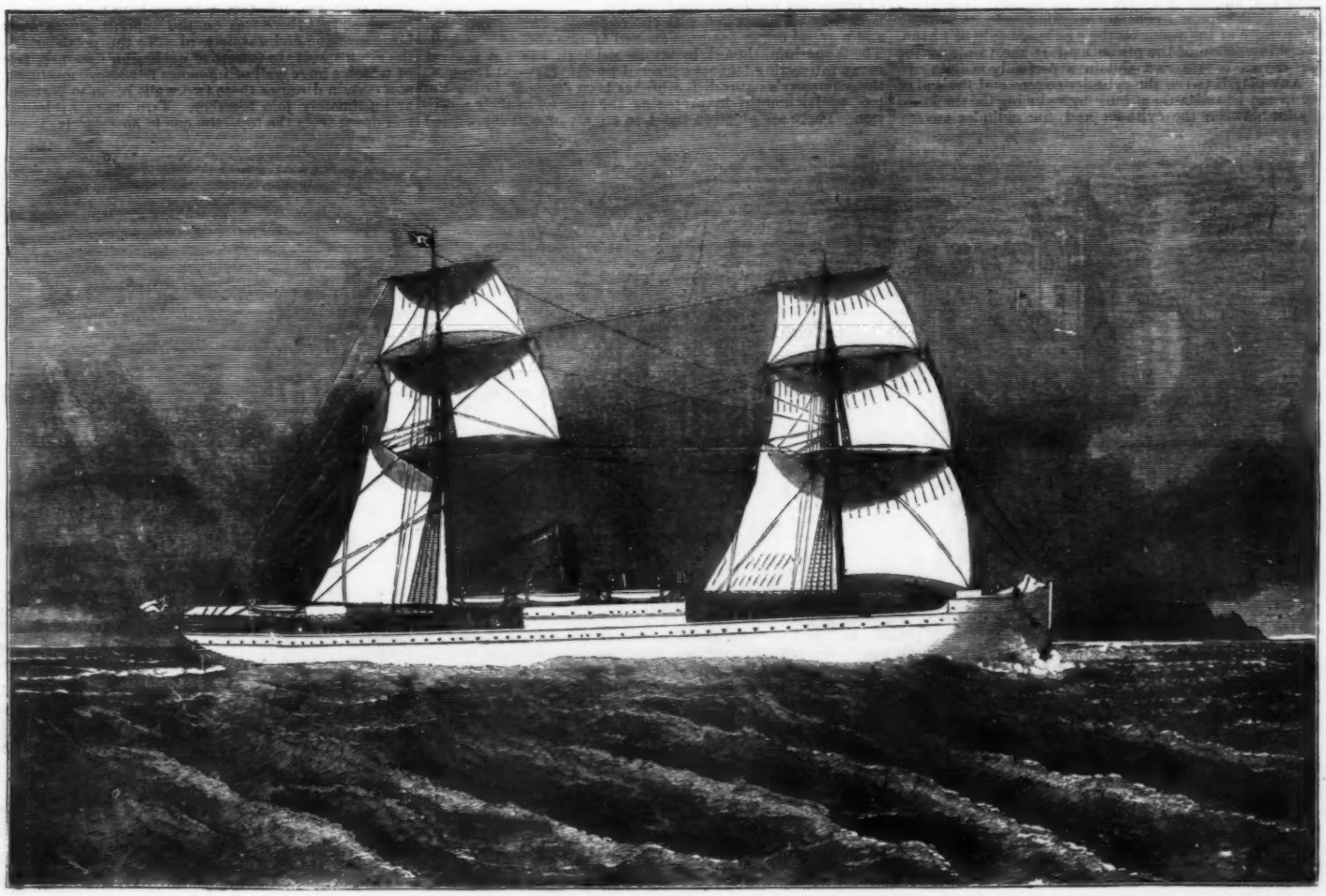
STEVENS' UNDERGROUND HAULING ENGINE.

THE STEAMSHIP "DUNROBIN CASTLE,"

Which conveyed the first detachment of troops and military stores from Capetown to East London at the commencement of the Kaffir war, is one of sixteen steamers employed by Messrs. Donald Currie & Co. in the Cape and Natal Royal Mail services. She is 342 feet long, 38 feet broad, and 28 feet deep, has a tonnage of 3,000 tons, and was built by Messrs. R. Napier & Co., of Glasgow, the well-known Clyde builders, who also constructed her engines, which are of great power. Her average speed is twelve knots per hour, and she can accommodate a hundred first class, seventy second class, and a hundred third class passengers.—*The Graphic.*

LABOR IN SCOTLAND.

THE United States Consul at Leith reports to the Department of State, at considerable length, numerous statistics and facts regarding labor and trade throughout Scotland. Among the Lothians he gives the income of farm laborers as, in 1873, $218 40 per annum; in 1878, $242 40. In the southwest of Scotland in 1873, $211 20; in 1878, $230 40; women in 1873, $127 20; in 1878, $144. In the northeast counties, men in 1873, $197 12; in 1878, $221 12. Female kitchen servants received in 1873, besides board, $55 20 per annum; in 1878, $76 80. In extreme northern counties, men, in 1873, $175 20; in 1878, $187 20. Day laborers get from 48 to 72 cents a day, an increase of 12 per cent. since 1873. Specially skilled or trustworthy men and women receive higher wages than those above specified. In most cases married men are paid monthly and single men half yearly. Married servants, who occupy cottages, as a rule, live a comfortable, happy, and moral life, giving their children a good elementary education. On the railways the wages per week are: For passenger conductors, $6 48; freight conductors, $7 20; porters, $5 04. Sunday labor is paid for at extra rates. Engineers receive $1 68 per day; firemen, 96 cents; laborers, 72 cents. Men in the linen works earn $6 per week; women, $2 65. A week is 56½ hours. Carpenters are paid $1 25 per day; blacksmiths, $1 05; masons, $1 50; laborers, 80 cents. A day is 10 hours, except with masons, whose day is 9 hours. Bookbinders earn $8 50 per week; shoemakers, $6 for 60 hours (as a rule they work by

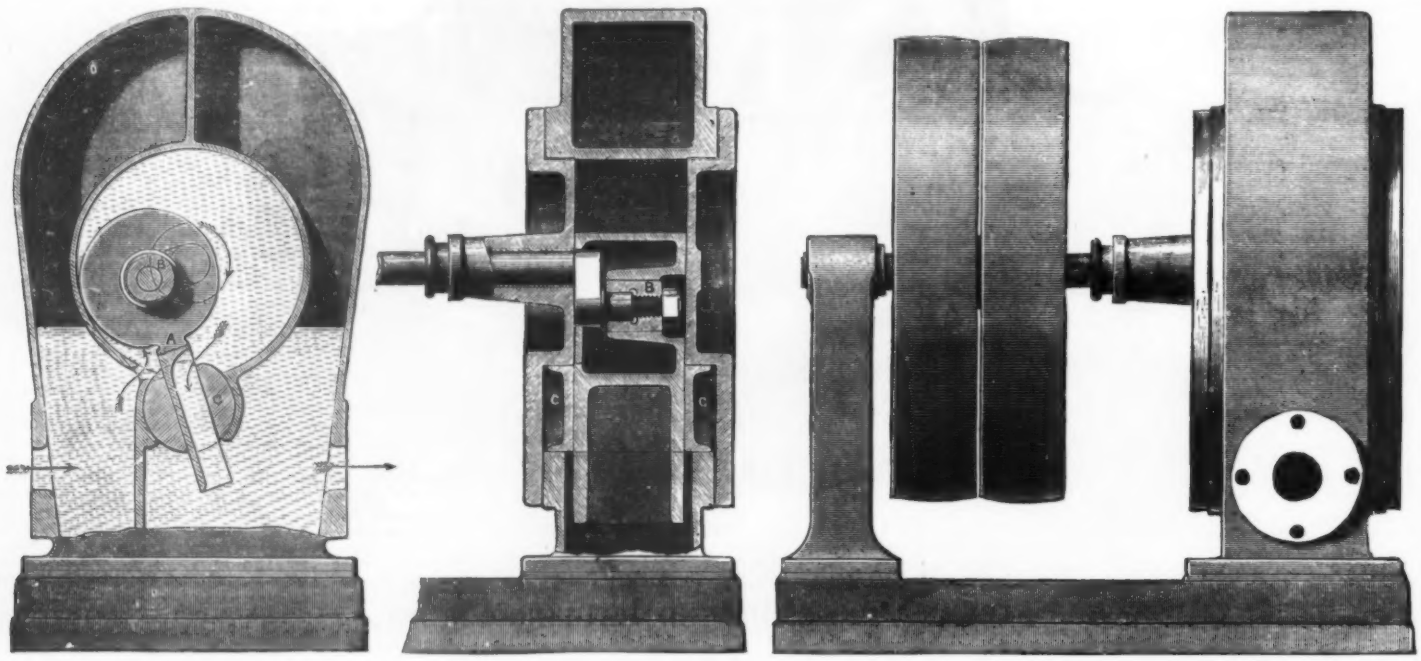


THE ROYAL MAIL STEAMSHIP "DUNROBIN CASTLE."

the piece); cabinet-makers, $7 20; printers, newspaper, night work, make from $11 to $18 a week, or more; day work, $7 80 (day hands work 51½ hours, night hands 48 hours per week); in publishing houses they earn $6 75 per 54 hours; painters get $7 65 for 51 hours; plumbers, $7 20; tailors generally by the piece, average $6 75 per week. The advantage in artisans' wages has not inured to their benefit so greatly as in the case of the farm laborer, the latter being much better off with board and lodging provided.

THE COMET PUMP.

IN the accompanying engraving we illustrate a somewhat novel pump, made by Messrs. Bartrum & Powell, Cornwall buildings, Queen Victoria street, London. The action of the pump may be described as follows: The crank-shaft is caused to rotate, and in doing so carries the piston, A, round with it against the inside of the cylinder, the center traveling round the dotted circle. The tailpiece of the piston travels up and down in the rocking guide, C. By this action on one side of the piston the water is drawn in at an opening in the cylinder, and on the other side the water that had been drawn in during the previous revolution is forced through the passage in the tail, and so on continuously, giving a constant delivery. It will be observed that the suction and delivery passages are never open to one another, and so there is no "slip." The adjustment between the piston and inside of cylinder is made by turning the small eccentric on the crank pin, and fixing it with the nut shown. The rocking guide, C, is kept at a constant working fit in its bearing by the pressure of the water on the discharge side of piston. The polishing action of the piston against the inside of the cylinder covers is said to maintain a perfectly smooth surface. Any play between the cylinder covers and the end of the piston can be taken up at once by reducing the thickness of the joint between the cylinder and the cylinder covers. In some cases this joint is made self-adjusting by placing a "saucer" plate between the end of the piston and the inside of the cylinder covers, to the back of which plate the water is admitted from the air vessel, thus keeping the working parts always in contact.—*The Engineer.*



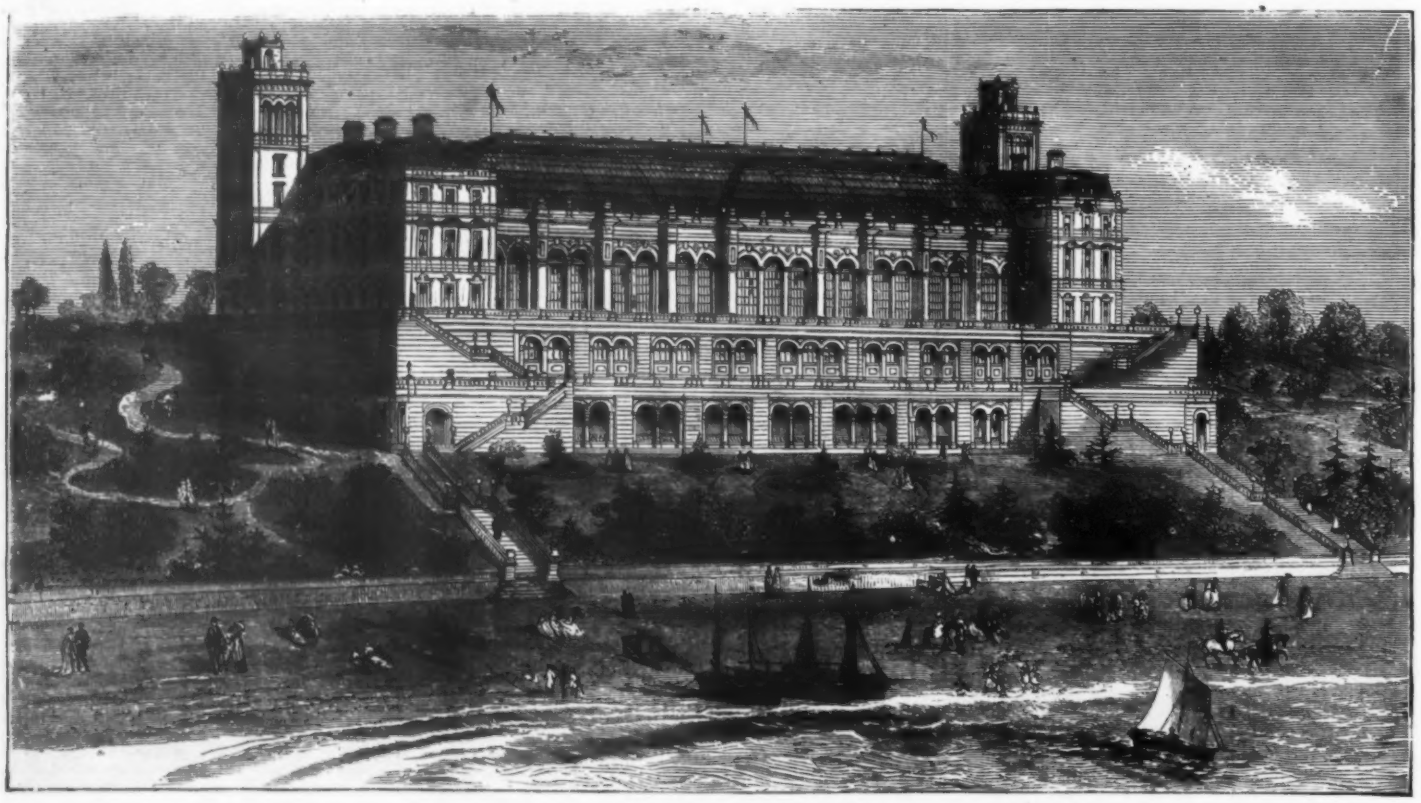
IMPROVED ROTARY STEAM PUMP.

THE TYNEMOUTH AQUARIUM.

THE new Aquarium and Winter Garden at Tynemouth, Eng., which was lately opened by Mr. T. E. Smith, M.P., the honorable member for the borough, has been erected by an enterprising company at a cost of about £80,000, the architects being Messrs. Norton & Mason of London. The building stands upon the precipitous cliff overlooking the Long Sands, and has a magnificent sea-frontage. It has two floors, the lower being devoted to the Aquarium and the upper to the Winter Garden. The Aquarium Hall is 216 feet in length by 50 feet in width, and upon the same level are refreshment saloon, storerooms, kitchen, cellar, and apartments for the attendants. In the basement beneath are an arcade of novel construction, and the heating chamber, reservoir, and engine room. The Winter Garden above is of the same dimensions as the Aquarium, and the walls are of stone filled in with glass, the dome-shaped roof being of iron and glass. The wings, which are not yet completed, will each contain an entrance hall, supper and billiard room, with various business offices, and a high tower, upon the roof of which a huge water tank will be placed as a means of protecting the buildings from fire. The Winter Garden is already well supplied with choice plants of many varieties, and a grand organ has been erected at one end of the hall. The Aquarium, though by no means full, has yet a great many interesting tenants collected by Mr. Howard Birchell, the company's naturalist, who has been engaged during the past twelve months in preparing the tanks for their reception. There are nineteen tanks in all, six of which are filled with fresh water, and the remainder with sea water, and through these a constant circulation is kept up at the rate of 14,000 gallons per hour.—*The Graphic.*

THE ANCIENT CAPITAL OF ULYSSES.

DURING an enforced absence from his cherished work in connection with the exploration of the Trojan district, which, however, he has once more been allowed to recommence, Dr. Schliemann has been devoting his attention to Ithaca, the island kingdom of Ulysses. His opinion is that the usually accepted idea that the valley of Polis is the site of the Homeric capital of Ithaca must be definitely abandoned. He afterward carefully surveyed the remaining northern part of the island, but found only in one spot the ruins of any ancient town, which he is inclined to identify as that mentioned by Scylax Per. 34, and Ptolemæus III., 14, 13. A careful exploration of Mount Aetos, situate on the narrow isthmus, hardly one mile wide, which connects northern and southern Ithaca, resulted in the conviction that in the same manner as the Acropolis of Athens was widened by Cimon, who included a large portion of its northeastern slope and filled up the lower space with stones and *débris*, the level summit of Mount Aetos was extended to the north and southwest by a huge cyclopean wall, still existing, the space between the top and the wall being filled up with stones and *débris*. Thus the summit forms a quadrangular even platform, 166 feet 8 inches long by 127 feet 4 inches broad, so that there was on the summit ample room for a large mansion and a courtyard. To the north and south of the circuit wall are towers of cyclopean masonry, from each of which a huge wall of immense bowlders runs down. But at a certain distance these two walls begin to form a curve, and ultimately join together. Two more cyclopean walls run down from the top—the one in an easterly, the other in



THE NEW AQUARIUM AND WINTER GARDEN AT TYNEMOUTH, ENG.

a southeasterly direction, and join the curve formed by the two first-named walls.

"Lastly," says Dr. Schliemann, "I have to mention a huge circuit wall about 50 feet below the upper circuit wall. This wall has fallen on the west side, but is in a marvelous state of preservation on the other sides. To increase the strength of the place the foot of the rock has been cut away so as to form a perpendicular rock wall 20 feet high. In the walls are recognizable three gates. Between all those cyclopean walls once stood a city, which may have contained 2,000 houses, either cut out in the rock or built of cyclopean masonry. Of 190 of these houses I have been able to find the ruins more or less well preserved. I measured 12 of them, and found them between 21 feet and 63 feet long and 15 feet to 20 feet broad. The usual size of the rudely-cut stones is 5 feet in length, 4 feet 8 inches in breadth, and 2 feet in thickness. The size of these stones by far exceeds that of the stones in the cyclopean houses I discovered at Mycenæ and Tiryns. Some of the houses consisted of only one room; others had four or even six chambers. From below not one of the houses is visible, and as the Ithacan peasants thought them to be mere heaps of stones, they did not point them out to foreigners, who might ascend Mount Aetos a hundred times without noticing any one of them, for the slopes of the Aetos ascend under an angle of 35°, and they are thus by 7° steeper than the cone of Mount Vesuvius; therefore it is exceedingly difficult and fatiguing to ascend Mount Aetos, the more so as it is full of pointed rocks and overgrown with thorny underwood and thistles. Besides, the path by which the peasants lead strangers to the top does not pass near any of the better preserved cyclopean houses; it passes only a few foundations, in which even the best archæologist may fail to recognize remnants of houses unless he has seen the better-preserved buildings. For all these reasons even Col. Leake only saw 'some terrace walls and some foundations of buildings on the side of the Aetos;' and from this remark of his no man could have expected to find here the more or less well-preserved ruins of 190 houses of Ithaca's most ancient capital. This cyclopean capital is unique in the world, and every admirer of Homer ought to come out and see it."

A few fragments of pottery and the remains of a curious handmill were the only results of a fortnight's exploration of these cyclopean remains, and similar bad luck attended a careful examination of the stalactite grotto near Dexia or Phorkys, where Ulysses is said to have hid his treasures, assisted by Pallas. Near the southeast extremity of the island, 4½ miles distant from Vathy, are a number of stable-like rooms, averaging 25 feet in length and 10 feet in breadth, partly rock cut, partly formed by cyclopean walls of very huge stones, in which Homer must have seen the twelve swine stables built by the divine swine-herd Eumæus. To the east of these stables, and just in front of them, thousands of very common but most ancient potsherds indicate the existence of an ancient rustic habitation, which Homer appears to have described to us as the house and station of Eumæus.—*Building News.*

PATAGONIA.

THE Buenos Ayres *Standard* furnishes some particulars of interest concerning Don Francisco P. Moreno's explorations in Southern Patagonia. The River Gallegos, it appears, has a mean velocity of four to five miles an hour, and is fed by the snows which fall in winter on the volcanic lands. It has two sources, which unite after a short distance, and two small tributaries to the south. The valley could be utilized for agriculture; on both banks mounds of lava are met with toward the south, forming black rocks with broken fragments like columns, wearing an appearance of an ancient city in ruins. All these peaks as far as Cape Virgin are extinguished volcanoes, of an average height of 860 feet. Don F. Moreno believes these eruptions to have been entirely independent of the Andine volcanoes. Between Gallegos and the banks of the San Gregorio, where these peaks are found, they have risen more irregularly than in other parts of Patagonia. The road winds capriciously through low valleys, watered by pools and rivulets, then through sterile tracts, and now and again over grassy elevations. At the confines of the Meseta (table-land) the face of the country changes. To the right the blue and white line of the snow clad mountains stands out in relief. To the left is seen the summit of San Gregorio, then the narrow Straits, and further off the Fuegian Plains, enveloped in fog and lurid fires. At the Brunswick Peninsula on the Straits the landscape is particularly verdant and undulating, with mineral veins here and there and small woods of the "Calafate" (*Berberis*), which produces a delicious fruit. With regard to the climate of these southern regions, in the western part rain and storms are continual, and it would be difficult to populate it, but on the east the climate is more favorable, and those sudden and terrible atmospheric changes that cause so many shipwrecks are unknown. Don F. Moreno is of opinion that the climate from the River Santa Cruz to Cape Horn may fairly be compared to that of Great Britain from the English Channel to the north of Scotland. On the high lands it is dry, with night dews, but little rain. In winter snow falls, but in spring, summer, and autumn the climate is delightful, with some few days of intense heat.—*Nature.*

LAND TRANSFER IN BABYLON.

MR. W. ST. C. BOSCAWEN has discovered among the contract tablets in the British Museum two documents of great interest to geometricians. Attached to two terra-cotta tablets containing deeds of sale of estates near Babylon, Mr. Boscawen found two neatly drawn plans of the estates in question. The first of these is a deed relating to the sale of some land which took place toward the latter end of the reign of Nebuchadnezzar. It represents an estate of about eight and a half acres in area, and bounded on the northern side by the canal of the goddess Banituo. The names of the owners of all the adjacent lands are given, and the greatest care is taken in giving the dimensions of these plots of land. The whole is divided into three pairs of parallelograms, and check dimensions are taken to test the accuracy of the work. A semicircular portion on the east side is most carefully measured, both radius and circumference being given. The second plan is unfortunately in a mutilated condition, but the remaining portions show the same care and neatness as is found in the perfect one. The deed of sale in this second document is written on the reverse of the tablet and is dated in the reign of Darius Hystaspes. The value of these documents as basis to which to fix both the lunar and area measures in use in Babylonia is very great. Both these documents form portions of the now well-known series of the Ejibi tablets. Mr. Boscawen hopes shortly to publish these documents, accompanied by fac-similes of the plans and translations of the deeds relating to them.—*London Athenæum.*

THE ANTIQUITY OF MAN.

A CORRESPONDENT of the Chicago *Times*, writing from North Wales, ventures upon a calculation of the antiquity of man in England from data furnished by the exploration of Kent's Cavern. He says:

In Devonshire, on the shores of Torbay, are two celebrated caves, one situated in the outskirts of the village of Brixham, the other similarly located in the beautiful town of Torquay. In both cases these caverns extend into the hills upon whose slopes they are situated 500 to 600 feet, the chambers and galleries being very large, tortuous, and irregular. The cave at Brixham, the mouth of which was completely closed by *débris* when accidentally discovered some years since, was most carefully explored under the auspices of the Royal Geological Society, which appointed the able geologist, Mr. Pengelly, to personally supervise the operation. The cavern at Torquay, known as "Kent's Cavern," is now being similarly explored by carefully removing its contents, amounting to many thousands of tons, under the same eminent management.

The similarity in the contents and revelations of these caverns is remarkable. Confining our attention to that at Torquay, which is the more recent and important in its disclosures, its floors are found to be composed, first, of a layer from 2 to 12 inches thick of decayed leaves and other vegetable matter, commingled with dust and fragments of limestone, which have fallen from the sides and roof of the cavern. Under this stratum of black mould, and sometimes peering up through it, is an extensive floor of granular stalagmite, or quite pure carbonate of lime, varying in thickness from a few inches to over five feet. Beneath the granular stalagmite, and at a distance of about 40 feet from the entrance to the cavern, occurs a stratum of charcoal, ashes, bones, and fragments of wood, covering an area of over 100 square feet. Below the charcoal band, and where that does not occur, immediately in contact with the floor of the stalagmite, is a thick stratum of red clay mixed with fragments of limestone (from the roof), scales of stalagmite, etc., the whole amounting to about 4 feet in depth, and called the "cave earth." Beneath the cave earth occurs another floor of hard crystalline carbonate of lime, having a thickness in some places of over 12 feet, called the "crystalline stalagmite." Below the latter lies a deep stratum, composed of fragments of limestone, red grit, quartz, and sand, all more or less cemented together by carbonate of lime in the form of stalagmitic deposit.

The interesting feature of this matter, which alone induced me to visit and inspect these caverns, is the fact that the relics of man are found embedded in every stratum of this cavernous floor, even to the last one mentioned. These relics in the bottom stratum consist of rude flint spear points and flint daggers or knives. Those implements found nearer the surface, as in the crystalline stalagmite, are better shaped, while in the cave earth are found many well-formed flint spears and arrow points, flint knives, bone daggers, bone needles with eyes, etc. Nearer the surface the weapons are more numerous and elaborate, and are associated with objects of ornament. Along with these implements of man are found a very large number of fragments of bones of living and extinct animals. Among the latter are the mammoth, rhinoceros, tichorinus, the gigantic Irish deer, cave bear, cave lion, etc.

The question at once arises, How old are these fossils? The problem is, to a large extent, one of chemistry. How long would the formation of such massive floors of stalagmite, deposited from water which still continues to drip from the ceiling of the cavern, require? In the calculation it must be remembered, first, that the drip must be moderate, otherwise the deposit would be washed away, and, secondly, that in these caverns evaporation, which so much facilitates the deposition of stalactites under bridges, etc., is wholly impossible. The formation of the stalagmitic deposit is wholly due to the difference of temperature in the cave (always 51° Fahrenheit) and that prevalent without. When the temperature of Devonshire was below this point, water slightly charged with carbonic acid, in percolating through the overlying limestone rocks, became charged with carbonate of lime; on entering the warmer cavern a portion of the carbonic acid gas escaped, and a part of the calcareous cargo was deposited as stalagmite.

Fortunately, in Kent's Cavern, we have at a point where the stalagmitic floors are thickest a kind of time scale or gauge. On a rather large knob or boss of stalagmite, by the aid of a tallow candle, I easily read this inscription, "Robert Hedges, of Ireland, Feb. 20, 1688," the letters, about an inch in length, having been cut or scratched in with a knife. Although the "hard" water still continues to drip on this name, 190 years have served to dim but not to deface the inscription. The film over the letters certainly does not exceed one-sixteenth of an inch in thickness. Putting aside the immense time requisite to the formation of all the other strata, it appears that the stalagmite floors alone at this rate would have required over 600,000 years for their deposition.

Enormous as this time seems, the calculation is corroborated in a remarkable manner by independent evidence. Although these caverns are situated more than 70 feet above the small stream on whose hillsides they are located, it is certain that the bottom stratum in each case was washed in. The proof of this statement lies in the fact that the bottom stratum contains large quantities of flints, red grit, and sand, which the walls of the caverns could not have supplied, but of which the supply is found at the heads of the streams. As water will not now, and probably never would, run uphill, it follows that the beds of these streams were at or near the level of the caverns where these materials were washed in.

The next problem, therefore, is, how long has it taken the rains of Devonshire to excavate in solid limestone valleys several hundred feet deep? How much limestone can the annual rainfall dissolve, and how much can it mechanically carry and push into the ocean? Prof. Huxley has estimated that the Thames basin, which consists principally of soft clays and chalk, is deepened at the rate of about the one-eighth of an inch per century. Applying this time scale to the present case, we find that more than 600,000 years are necessary for this work. As the excavation was, however, through hard limestone instead of chalk, and as the mouth of the cave at Brixham is nearly 100 feet above the present level of the creek, it is evident that the time should be lengthened. But man was in Devonshire before these valleys had been cut deeper than the mouths of these caverns, and long before an inch of the stalagmitic floor had been deposited.

Diminish the time involved in these facts and calculations in any reasonable manner as much as possible, and still the time during which man has lived in England is enormous as compared with our previous conceptions. Unless we admit that England was the cradle of the human family, the figurative Garden of Eden, these facts only point to the antiquity of man in Devonshire, but do not fix the true antiquity of the race.

A PREHISTORIC FOUNDRY AT BOLOGNA.

M. E. DESOR has read to the Society of Natural Sciences of Neufchâtel, an interesting memoir upon some discoveries of prehistoric remains lately made in and near Bologna. He says the evidences of prehistoric Italian civilization lately obtained from diggings in that district (at Villanova, Bonzano, Arnoaldi, Benacci, and Luca), notwithstanding a resemblance to the true Etruscan type, have, in many respects, a definite special character ("type of Villanova"). As it was impossible not to see what a near relationship unites the art products found about the banks of the Reno with those of the Swiss lake stations of the bronze age, and with those of the Gallic of the commencement of the iron age, and as even a portion of the local differences lose in importance from the circumstance that the one series of objects was specially destined for the service of the living, and the other for the adornment of the dead, the supposition that they had a common origin was easily arrived at. Their common source was supposed either to be among the comparatively more advanced peoples of the plain of the Po, or, as no place for their production *en gros* has yet been found there, in the old seat of the bronze civilization at the foot of the Caucasus. About a year ago, in the middle of Bologna, near the church of St. Francis, M. Zannoni, an engineer, came upon a great earthen vessel, 4 ft. 8 ins. high and 4 ft. broad, at a depth of about two feet. In this there were 14,000 bronze articles of admirable workmanship, packed together as closely as possible, and all coated with the ordinary green patina. MM. Desor and Berthoud came to Bologna just when the whole contents of this vessel were exhibited in the Town Hall. Of celts there were 2,077, from rough, wedge-shaped ones to the most highly finished and engraved specimens; 2,407 fibulæ in 25 principal forms; a great number of knives of every form and size, and also in part engraved; hundreds of chisels and a good many gouges; 275 lance heads, varying greatly in length up to more than a foot, although remarkably similar in form; half-a-hundred sickles, many of them very large. Of bits for horses there were about 60, made evidently for a considerably larger race than that of the Swiss lake stations. There were fish hooks, harpoons, hammers, a large anvil, a plane, and a dozen saws. Further, several hundred different bracelets, all massive, with the ends often in the shape of the heads of animals; numerous hair pins, although comparatively fewer than in Switzerland, and usually with flat heads; 50 razors with small handles; numerous ornamented plates, the pattern of which in part resembled those of Villanova; a comb; short tubular pieces with appendages like ear-drops; quadrangular plates with markings, regarded by Gozzadini as little bells. The weapons were comparatively few, and consisted of daggers, arrowheads, and swords. With all these were casting moulds both of hard bronze and of earth.

The preservation of the specimens was not quite uniform. Among the hatchets there are some quite rough, still showing the line of junction of the moulds; others worn, and others quite new. Of the fibulæ also, some are injured and others quite perfect; some have the tongue damaged or lost; in others it has been refixed with a small iron rivet, or completed by a small lamina of bronze of suitable form. If to all this we add, that fragments and waste pieces were not wanting, and were certainly intended to be melted up, there can be no doubt that we have here the indications of an establishment in which articles were cast and repaired. It was probably in time of danger, perhaps of a hostile attack, that the possessor of these numerous articles packed them so closely into the smallest possible space, without being able to recover his property, as, fortunately for us, its recent discovery proves. No doubt from such a workshop, of which, perhaps, we have by no means all the remains before us, exportation was carried on, as this would be easier than the export of pottery, even over the mountains.

Thus it would seem that we have here a source of bronze objects for Italy and perhaps also for Switzerland, but at the same time it must be remembered that the articles found show differences from those of the Swiss lake stations. Many objects, such as the large sickles and lance heads, the most abundant form of fibulæ found at Bologna, the protections for the arm made of bronze wire, the elegant hollow cylinders, probably ornaments for the hair (*tutuli*), axes such as would serve for chopping wood, and large nails from six to eight inches long, are either rare or entirely wanting so far as we know north of the Alps, or, in place of them, other forms are found. On the other hand we miss, at Bologna, the large, hollow, engraved bracelets, and the round-headed hairpins of Switzerland.

The determination of the age of these remains would be important, as it must at the same time throw light on that of the Swiss lake stations. Whether belonging to the first development of the Etruscans ("Proto-Etruscans") or to another people, the civilization of Villanova and Bologna was certainly earlier than the true great Etruscan period. Upon this question, and in what relation if any these inhabitants stood to the Mediterranean peoples who in the fourteenth century before our era made head against the Pharaohs both by land and sea, further information is much to be wished for.—(*Neues Jahrb. für Min. Geol., etc.*)—*Popular Science Monthly.*

AERIAL RESPIRATION IN FISHES.

PROFESSOR JOBERT, of Dijon, who is now engaged in making some zoological investigations in Brazil, at the instance of the Emperor Dom Pedro, has ascertained some exceedingly remarkable facts in connection with the respiration of certain fishes. A Siluroid fish, which inhabits the neighborhood of Rio de Janeiro (*Callichthys asper*), and is noted for its power of living a long time out of the water, was found by him to swallow small portions of air, from which it partly absorbs the oxygen by the agency of the walls of the intestinal canal, the carbonic acid formed, and the unabsorbed nitrogen passing away by the anal aperture. On examining the structure of the intestine, Professor Jobert found its inner surface bearing a multitude of filiform appendages arranged in tufts, and composed essentially of blood-vessels.

A somewhat analogous case was observed in several other fishes inhabiting the valley of the Amazon. They live in stagnant water, the temperature of which often exceeds 104° F.; but this does not appear to be sufficient to support their respiration, and they are obliged to come frequently to the surface for a supply of air. Sometimes, also, the water in which they have been living is dried up, when they are seen making considerable journeys by land in search of more favorable localities, crawling on the ground by means of their pectoral fins. Some of these are species of *Callichthys*,

and, like the *C. asper* of Rio de Janeiro, they possess a double respiration—respiring the air contained in the water surrounding them by means of their gills, and also the atmospheric air which they swallow, and which passes through their intestines The escape of the exhausted air from the anal aperture in these fishes is said to produce a constant bubbling in the water they inhabit, and M. Jobert's investigations, though imperfect, sufficed to convince him that the air evacuated contained much carbonic acid, and less oxygen than atmospheric air. The vascular tufts clothing the wall of the intestine originate from adjacent veins, in the same way as the afferent vessels of a lung. Species of *Doras* and *Hypostomus*, inhabiting the Upper Amazon, respire air in the same way as the *Callichthyes*, but in the *Hypostomi* the used air is returned toward the mouth, and escapes by that orifice or by the branchial apertures.

In *Sudis gigas* and some species of *Erythrinus* aerial respiration takes place by the agency of the swimming-bladder, which, in the latter, has long been known to communicate with the outer world through the œsophagus, and to be furnished internally with numerous cells formed by membranous folds. Professor Jobert finds that the walls of the swimming-bladder, including all these folds, are richly provided with blood vessels, mostly originating from the venous system, and that it is thus converted into a true lung, by the possession of which the fishes are enabled to live for a long time out of the water. Of the reality of this respiration, Professor Jobert convinced himself experimentally by obstructing the air-duct leading to the bladder; the fish soon died by suffocation. These observations are particularly interesting as establishing further bonds between the true fishes, the Lepidosirens, and the perennibranchiate Batrachians, which possess at the same time branchiæ and true lungs.—*Comptes Rendus.*

A CURIOUS FUNGUS.

By W. H. GIBSON.

THE accompanying illustration represents a strange eccentricity in the way of a fungous growth which I discovered only a few weeks since while on a vacation in Sandy Hook, Conn. I was, at the time, sketching in a secluded ramble near the Housatonic, and having paused in my work to partake of my noonday lunch, was carelessly busying myself in overturning a clump of moss by my side.

Multitudes of insects, surprised by the unusual commotion, ran hither and thither in confusion, and secluded themselves in the crevices of the spongy log beneath. I at last struck upon something so unusual in appearance as to at once arrest my attention. It was a shiny brown chrysalis, with a yellowish lump growing from one end. On close examination I discovered the lump to be the cap of a small fungus, and the stem beneath was about three-quarters of an inch in length, serpentine in its growth, and seemed to hug the end of the chrysalis, and its roots were embedded within the substance of the pupa. With the aid of a penknife I carefully lifted the shell of the chrysalis and observed a perfectly formed moth within the interior. The insect was dead; whether killed by the attack of the fungus or not it was impossible to tell. The rootlets of the parasite had penetrated the interior of the case, and had insinuated themselves beneath the wings of the inclosed insect.

I wrapped the object in some of the moss and carried it home. On the following morning I was surprised to find the fungus much increased in size, having grown to the length of three inches or more, two inches of which had been acquired in a single night. It shortly commenced to wither, and shed its spores in the form of a white mould on the moss beneath. I have retained the moss, and hope to be able to reproduce the plant by affording similar conditions.

In its prime the fungus was about three and a half or four inches in length. The stem was rather eccentric in its outline, having been curved originally in its compressed growth beneath the moss.

A CURIOUS FUNGUS.

It was yellowish white in color, slightly twisted, and having an occasional bract or scale. The cap was orange in color, three-quarters of an inch in length, and studded with minute brownish points. The chrysalis was about an inch and a half in length.

I could not ascertain the species of insect which had served as its victim, as the wings were so affected by the action of the rootlets, and the exterior form of the pupa case had no striking characteristics by which to identify it.

IN France handkerchiefs printed with chloride of cobalt are sold under the name of "Foulards Barométres." The design represents a man with an umbrella. In fine weather the umbrella is blue; in changeable, gray; and in rainy weather, white. The first washing removes the chloride of cobalt, and the handkerchief loses its barometric properties.

A NEW FOSSIL BIRD.

OUR illustration represents a fossil bird discovered in the schistose clays of Colorado, and recently described by Mr. J. A. Allen. The remains, which were found in a remarkable state of preservation, comprise the greater portion of a skeleton, embracing all the bones of the anterior and posterior extremities except the femurs. Unfortunately the bill and the anterior part of the head are wanting, but the shape of the head and neck is very distinct. The bones are all *in situ*, and evidently indicate a high ornithological type, evi-

NEW FOSSIL BIRD FROM COLORADO.

dently allied to the sparrow tribe. The specimen also shows with remarkable distinctness both the wings and tail, not only in the general form of these parts indicated, but, what is still more wonderful, the quills and barbs also. As to general dimensions, the species differs little from the scarlet tanager (*Pyranga rubra*) or cedar bird (*Ampelis cedrorum*). The bones of the wings, as well as the wings themselves, offer an analogous alar development, but the tarsi and feet are a little smaller; and as regards the latter point, there is considerable analogy with the short-legged pewee (*Contopus*). These features indicate an arboreal life and well-developed powers of flight. The absence of the bill will not allow of this bird being classed in any particular family, but, taken altogether, it appears to exhibit nearest affinities with the *Fringillidæ*. It has been named *Palæospiza bella*. Its wings are somewhat long and pointed; the tail appears to have been two-thirds of the length of the wings, and is somewhat rounded, and the outer feathers are much shorter than the middle ones. However, the true character of the tail can be determined only imperfectly, since it is not at all certain that, in the specimen before us, we have its correct shape or the exact form of its extremity; this appears the more probable from the fact that it presents a certain want of symmetry. The legs and claws belong, as may readily be seen, to a perching bird, and the proportional length of the bones of the anterior and posterior members is the same as that of the common arboreal sparrows, especially that of the *Tanagridæ*. The most remarkable thing about this fossil is the perfect state in which the feathers are preserved, both quills and barbs being exceedingly well defined; and the extremities of the feathers of one of the wings may even be seen very clearly through the partially spread tail which covers them. The feet are so well preserved that all of the claws are still perfectly recognizable. Another specimen from the same locality, and probably of the same species, is very imperfect, and consists merely of a portion of the end of the tail and two-thirds of a half-spread wing.

This bird is very interesting as offering the first fossil sparrow as yet discovered in North America. The specimens are in possession of the Boston Society of Natural History.

A NEW textile is produced under a recent French patent by combining the effects of weaving and printing. The cloth in question is first woven of white and black, or other dark yarn, in such a manner as to produce checks, and have the effect of ordinary canvas for worsted work; upon this cloth any desirable design is printed in colors, which will then appear on the white squares only, and not upon the dark lines, and thus have all the appearance of worsted work. It is said to have a most charming effect in chintzes for furniture and similar goods, giving a more realistic appearance than when the squares are printed with the colors.

ROSOLIC ACID AND ROSANILIN.

By H. CARO and C. GRAEBE.

THE authors retain the name rosolic acid exclusively for the acid $C_{20}H_{14}O_3$, which is obtained from rosanilin, $C_{20}H_{19}N_3$. Aurin is the compound of phenol and para-rosanilin. Aurin and para-rosanilin agree in this property, that they are precipitated by hydrochloric acid from a hot alkaline solution in very characteristic needles, fine as hairs, which dissolve without melting in the dilute boiling liquid, and on cooling appear as a heap of felted needles of a reddish yellow color, and a luster resembling chromic acid. Under the same circumstances rosolic acid forms confused resinous drops of a metallic green, which congeal slowly and never form needles. The authors are of opinion that rosolic acid, rosanilin, and their accompanying leuco-compounds are derivatives of one and the same hydrocarbon. Rosanilin and rosolic acid are derivatives from a tolyl-diphenyl-methan; aurin and para-rosanilin from triphenyl-methan.

ANALYSIS OF BEHAR OPIUM-ASH.

By C. J. H. WARDEN, Surgeon H.M.S. Bengal Staff, Off. Principal Assist. Opium Agent, Behar.

THE following is the result of an analysis of opium-ash, obtained by preserving the ashes of all samples of Behar opium analyzed at the Government Opium Factory, Patna, for some years past:

Fe_2O_3	1·9859
Al_2O_3	traces
Mn_3O_4	traces
CaO	7·1344
MgO	2·3104
K_2O	37·2405
Na_2O	1·7006
SO_3	23·1419
P_2O_5	10·9021
CO_2	traces
Cl	traces
SiO_2 and sand	15·2740
	99·6878

The ash was of a very light gray color, and contained 0·8575 per cent. of charcoal, which was deducted before calculating its percentage composition. It yielded to boiling water 58·4961 per cent. of soluble salts. The aqueous solution gave marked indications of the presence of SO_3, P_2O_5, and K_2O.

The large amount of SO_3 present in the ash is noteworthy. The acid is usually considered to be in combination with potash and lime. According to Christison, sulphuric and meconic acids are the solvents of the active principles of opium. Bilty, in *Buchner's Repertorium*, xxxix., quoted by Christison in his "Dispensatory," gives 2 per cent. as the amount of sulphate of potash contained in Turkey opium. Sulphuric acid is also a constituent of the poppy plant ash. Mr. John Scott, in his "Manual of Opium Husbandry," gives analyses of poppy plant ash, in which the SO_3 varies from 5·93 to 10·08 per cent. And Mr. Scott points out that the larger the amount of sulphuric acid in the plant, the smaller is the yield of morphia, thus:

SO_3 in Plant-ash.	Morphia in Opium.
5·93 per cent.	8·66 per cent.
7·64 "	6·47 "
10·08 "	4·65 "

It would be interesting to ascertain whether or not there is a similar correlation between the SO_3 in opium-ash and the amount of morphia contained in the drug. Possibly the SO_3 in opium may be directly proportional to its richness in morphia.

The iron present in opium-ash is doubtless introduced by the abrasion of the iron instruments used for scarifying the poppy capsules, and for collecting the exuded juice.—*Chem. News.*

GELATINE, GLUE, AND BONE SIZE.—Gelatine, glue, or bone size is the result of the molecular transformation of the cellular tissue which forms the greatest portion of skins and of the animal matter of bones. To obtain the conversion, water and heat are required. The first transformation of the animal matter of bone into size (now used on such an extensive scale by plasterers, and for the finishing of fustians or other cotton fabrics) was by Pepin, in 1651. This product is obtained by first boiling bones in open vessels to remove the grease; then is added the pressure of from 28 lbs. to 40 lbs. to the square inch, or when water boils at a temperature of from 250 deg. to 275 deg. Under this temperature, about 30 per cent. of animal matter in bones gives from 23 to 24 per cent. of gelatine. Glue is generally prepared from pieces of skin or other animal tissue, boiled under the same circumstances. Gelatine is the name applied to a better quality of glue. It is principally prepared by two processes; one of which consists in placing broken bones, deprived of grease, in a cast-iron boiler, and throwing into it steam at a pressure of one atmosphere. The gelatine thus produced is allowed to escape at the bottom of the boiler, in solution, having been dissolved by the condensed steam. In the other process, the mineral matters of bones are removed by weak acids, washing the animal tissue which remains, and bleaching it by sulphurous acid; next submitting it to steam pressure, which converts it into gelatine.

IODINE AND BROMINE FROM KELP.*

By ROBERT GALLOWAY, F.C.S., Professor of Chemistry in the Royal College of Science for Ireland.

HAVING had, some time ago, facilities for becoming completely acquainted with the manufacturing processes followed for the extraction of iodine, bromine, and the potash salts from kelp, I devoted a considerable portion of time to the study of this branch of manufacturing industry. It is one of the manufactures which ought to flourish in Ireland, owing to the large quantity of the raw material (sea weed) which can be obtained in this country. I am sorry to have to state that there is now no kelp factory in Ireland; the only buyers of Irish kelp at the present time are the Scotch manufacturers.

The descriptions in works on chemistry of the processes followed for the extraction of the kelp products are very meager in a manufacturing point of view, especially as regards the extraction of the two most valuable substances, iodine and bromine, and these two substances are the most difficult to extract with manufacturing success. The de-

* A Paper read before the Royal Irish Academy, April 8, 1878.

scriptions state that such and such processes are followed; but important details are altogether omitted, as, for instance, the conditions most suitable for carrying out the processes successfully, and the different precautions which ought to be observed.

Iodine was at one time a monopoly. The iodine manufacturers combined together not to sell this substance under a certain price; which, like all other monopolies, had the effect of impeding rather than of promoting improvement in this branch of manufacture. The monopoly exists, I believe, no longer; new sources of supply of the substances I have termed kelp products—iodine from the mother-liquors obtained in refining the nitrate of soda in Peru, bromine and potassic chloride from the salt beds in Prussia—have not only extinguished it, but have also rendered necessary the adoption of superior and more economical methods in the extraction of these substances from kelp for the continuance of kelp being employed as a raw material.

Many methods have been proposed for the extraction of the two metalloids, iodine and bromine, from the ash of seaweed; but the only one, as far as I am aware, which has been followed in the United Kingdom, at least up to a very recent period, is the one ascribed to Wollaston. By this method they are set free from the metals with which they are combined by the addition of sulphuric acid and manganese peroxide to the mother-liquor which remains after the extraction (of course as far as it is practicable) of potassic sulphate and chloride, and what are termed the kelp salts, which are a mixture of sodic sulphate, carbonate, and chloride.

The sulphuric acid is added for a twofold purpose: a portion is required for the decomposition of the alkaline sulphides, sulphites and hyposulphites present in the mother-liquor; the other portion, along with the manganese oxide, liberates the iodine and bromine from their combinations. When the sulphur which is set free from the decomposition of the hyposulphites has completely deposited, the clear liquid is drawn off into the iodine still, and the manganese peroxide is then added to it.

When this process first came into operation, bromine had not been discovered in the ash of sea-weed; even the late Dr. Anderson in his well known and often quoted analyses of the ash of sea-weed, does not give it as a constituent. New analytical investigations of the ash of the various sea plants are wanted; the plants ought to be carefully freed, before incineration, from all adhering salt water, so that the quantities of chlorine, bromine, and iodine they naturally contain might be correctly ascertained. The investigation would lead, most probably, to the discovery that there are, properly speaking, *bromine* as well as iodine producing plants.

The three metalloids are each liberated from their metallic combinations by the manganese peroxide and sulphuric acid, but owing to their different degrees of affinity for metals—chlorine having the strongest and iodine the weakest affinity—the latter is the first set free; but it requires the greatest care and attention to prevent some portion of the other two from being set free at the same time. If this occurs, they enter into union with one another, forming volatile compounds which affect the eyes, and have a very pungent odor. The liberation of the bromine or chlorine, or both, during the extraction of the iodine may occur, for instance, from the manganese oxide becoming unequally diffused in the liquid; they will also be liberated if the temperature of the liquid becomes too high; and it appears to me highly probable that the influence of *mass* will also cause their liberation, especially when the quantity of iodine becomes, by volatilization, much decreased in quantity. That they are liberated to some extent during the distillation of the iodine is at once perceived by those who visit the still during the distillation, and who are acquainted with the properties of these compounds. I may here observe that the still man judges whether at least an undue proportion of the other two are volatilizing by the color of the vapor; if it is of a brownish or whitish color he is aware he is losing iodine. When the distillation is finished, and the still head removed, the vapor which escapes from the still has always a violet color, and some iodine always remains in the liquid; for if the distillation were continued until all the iodine had volatilized, there would be evolved along with it in the last stages one or both of the other metalloids in somewhat large proportions; and consequently there would be a loss instead of a gain in iodine. These are some of the imperfections and difficulties of Wollaston's process.

The extraction of bromine follows the extraction of iodine, the same process being adopted, and similar precautions have to be observed.

It is evident such a process is unsuitable for the extraction of valuable substances like iodine and bromine, and it may also be observed that the liquid from which they have been volatilized has to be thrown away, on account of the difficulty of utilizing it, although it contains a large quantity of potash salts and all the sulphuric acid employed in the extraction; the money value of which is estimated to be nearly one-half of the whole cost for extracting all the products from the kelp.

Chlorine is the agent, out of the many proposed as substitutes for the manganese oxide and sulphuric acid, which I would recommend, but under conditions somewhat different from those I have seen described; this difference in the conditions would render the process more exact, and better results in every respect would be obtained. The kelp solution I would render neutral by the addition of sulphuric acid before adding an aqueous solution of chlorine; and as I have found by investigation that the kelp solution contains clay, and as this substance tends to render the solution viscid and unfavorable for crystallization, I would, before evaporating to obtain the last crop of potassic chloride, nearly neutralize the liquid so as to get rid of it. Although a little more acid would be consumed than if it were all added in the ulterior stage, the disadvantage would be more than compensated by the larger crop of crystals of potassic chloride which would be obtained and the greater concentration of the liquid. After the extraction of the last crop of potassic chloride, I would neutralize the liquid exactly, and then place it in a graduated vessel; I would then add to a small measured portion of it some bisulphide of carbon, and finally some chlorine water from a graduated vessel, until the violet color just disappeared. This is a process frequently employed for the estimation of iodine, and occupies only a minute or two. Having ascertained the exact quantity of chlorine water which decolorizes the iodine—that is, converts it into pentachloride of iodine—it would only remain to add to the larger measured quantity of the liquid containing the iodine one-sixth of the relative quantity of the chlorine water which was required on the smaller scale. The small portion of iodine which would remain dissolved in the liquid, owing to its slight solubility in water, I would remove either by bisulphide of carbon or benzol. After the removal of the iodine I would treat the liquid with chlorine water, with similar precautions for the removal of the bromine; but as the compound of chlorine and bromine is a monochloride, one-half, and not one-sixth, as in the case of the iodine, of the relative quantity of chlorine water would have to be added to the larger measured portion of the liquid.

If, in any case, it should be found desirable not to precipitate the entire portion of the iodine and bromine with chlorine water, on account of rendering the liquid too dilute, a portion might first be precipitated by chlorine gas, and the remainder by means of chlorine water in the way I have described.

This method would not only be speedy, but exact, for it would be the conversion of a quantitative analytical operation into a manufacturing process. After the removal of the bromine, the alkaline salts which remained in solution could be easily recovered.

It would be necessary to sublime the precipitated iodine.

THE NEW WHEAT FIELD.

HERODOTUS stated a truth of human nature when he said that geographers represent all beyond the known and explored localities of the world as barren deserts, sands, and wastes. It is just as true now as it was in his time, twenty-three hundred years ago. The "Great American Desert" with its vast proportions was familiar to the geography of our boyhood, and yet we have seen samples of grain from portions of that self-same desert that would do credit to Eden. Nature's appearance is not at all indicative of her resources or capabilities. The ugliest looking gulch may yield the biggest nugget, and the most forbidding-looking desert may be made to blossom into usefulness, if not into beauty, by passing under the dominion of man.

Dakota and Minnesota were not included in the "Great American Desert," but some portions of them were given anything but an inviting name by geographers and explorers. A few years ago no one, except possibly some of the inhabitants of Minnesota, dreamed that she would become one of the first, if not the first, wheat-producing State in the Union. Her crop this year amounts to between twenty-five and thirty million bushels, while that of Dakota reaches nine million bushels; remarkable figures, truly, but more astonishing still when we remember that a few short years ago a large part of Minnesota and Dakota was considered a barren waste, where nothing could ever be raised. This portion of these States was the Red River Valley of the North, which has within the last three or four years become noted as the greatest wheat section of the country.

For wheat culture the experience of the past two years seems to prove that this locality is the most favored portion of America. In parts of Iowa and Southern Minnesota the wheat crop this year was almost a failure, while way up in Dakota, in latitude 47, and not far from the British boundary line, the yield has been abundant.

The Red River Valley contains an area of about thirty thousand square miles, making it about the size of the State of Indiana. It is about four hundred miles long, and will average eighty miles in width. The soil is a rich loam resting on clay. The plain is level, and almost treeless. The landscape is certainly not inviting, and travelers and explorers, among them Gen. Hazen, pronounced the country a worthless desert. As the latitude was high, the valley lying between 46 and 50 degrees, every one thought that the climate was too cold and the seasons too short to raise anything. Besides there was little water away from the banks of the river, and nature seemed to have been very sparing in bestowing gifts upon that part of the world.

However, the Red River Valley was settled by a hardy race of men who were sure to prove ultimately whether anything could be done with the soil or not. We do not know who first ventured to sow it with wheat. The result must have surprised him and his neighbors, who are now the owners of wheat fields whose dimensions vary all the way from a thousand to ten thousand acres. In some parts of the valley you can stand in a sea of wheat, extending as far as the eye can reach. The pictures drawn of these immense wheat fields would hardly be credited; and the acreage that has already been placed under cultivation seems marvelous for a new country, both in the aggregate amount and in individual instances like that of Mr. Dalrymple's immense farm. Still, only a fraction of this valley has been laid under tribute. It is said that every acre of the whole valley can be cultivated, and that nowhere can ledges, bowlders or sand be found. Thus far, experience has shown that wheat is a certain crop in the Valley, and the yield is from eighteen to twenty-five bushels per acre. A little reflection will show what importance as a wheat-field this locality is likely to assume in the future. Here is an area large enough to form a good-sized State, almost every acre of which is capable of raising wheat. Enthusiasts say that the Red River Valley can raise more wheat than the people of the United States can consume, and appeal to figures to prove it. Such assertions may appear very erroneous, but their verification is not beyond the bounds of possibility. The history of the past two years certainly seems to intimate that the great wheat-field of the country is destined to be the Valley of the Red River of the North.—*American Miller.*

RAVAGES OF THE PHYLLOXERA.

THE Paris correspondent of the *Pall Mall Gazette* writes that in spite of the reported discoveries of efficient means of protection against the phylloxera, that terrible insect still continues its ravages, setting at naught the decisions of departmental commissions and acts of Parliament. The news from Cognac is most serious. Four cantons have been invaded by the phylloxera—Cognac, Jarnac, Segonzac, and Châteauneuf—and in the 16 communes which furnish the grand champagne the vines only yield a tenth of what they used to do. In the Commune of Château-Bernard, which formerly produced 10,000 barrels of wine, there is not a vine undamaged. Fortunately, the Charentes, which are also brandy producing departments, and which give us armagnac, are still free. Bad news also reaches us from Nice and the Antibes, where the phylloxera has also appeared, and is being met, with what success is not known here, with a preparation of sulphur. Similar tidings come from the Indre, which is in the center of France; and, what is worse still, from Burgundy. There the phylloxera has made its appearance among the vineyards of the Haute Bourgoyne, at Mersault, so celebrated for its white wines. The insect has even dared to venture into the experiment gardens of Dijon, thus braving science in its capital. In the Hérault the phylloxera continues to spread, regardless of all opposition. In the department of Vienne the insect has also made its appearance, that is to say, at a point which is not connected with any other infested districts. The phylloxera, it is calculated, has devastated some 300,000 hectares (750,000 acres), and so there only remain 2,000,000 hectares (5,000,000 acres) in which the vine still flourishes. In 1865 the vineyards yielded close upon 70,000,000 hectoliters of wine, and in 1869 over 71,000,000. Now only about 40,000,000 can be counted upon; although such was the extraordinary yield in 1875 of the departments not attacked by the phylloxera that the enormous figure of 82,000,000 was attained. In the stricken districts the produce has been rapidly declining since 1869. In that year the Hérault yielded over 15,000,000 hectoliters, now it only yields 6,000,000. The Gard used to supply us with 2,000,000 hectoliters, now it only furnishes 200,000, and in seven other departments there is a similar falling of in the yield. A hectoliter, it will be remembered, is equal to 22⅛ imperial gallons.

ANALYSES OF CORN, BEEF, MILK AND SKIM-MILK.

AT the fair of the Farmers' Club, now open in Boston, Mass., fifty American corns and two hundred varieties of wheat from all countries are shown. Also the first comparative analyses ever made of Eastern and Western corns, contributed by A. L. Murdock and Prof. S. P. Sharples, of Boston, as follows:

	Water.	Fat.	Albuminoids, or Flesh Formers.	Carbohydrates, or Sugar, Starch and Gum.	Cellulose, or Wool.	Ash, or Minerals.
Golden, 8 rowed, Mass.	13·61	4·94	10·25	69·87	1·35	1·98
Mason County, Illinois.	13·61	5·62	9·19	69·10	1·18	1·35
Kansas	11·84	4·60	8·61	73·80	1·36	1·07
Massachusetts White Flint.	10·88	5·40	9·33	74·25	1·47	1·44
Massachusetts Red Flint	11·95	5·40	12·56	69·47	0·03	1·10
Burr's Sweet.	10·66	7·77	11·69	68·70	4·04	2·33
Stowell's Evergreen Sweet, by Professor W. O. Atwater	10·86	7·66	11·10	65·86	3·63	1·89

Thorough-bred and Grade Ayrshire, Devon, Guernsey, Holstein, Jersey, and Short Horn Cows, contributed by A. L. Murdock and Professor S. P. Sharples, of Boston. Of our Cows, one per cent. are Thorough-bred, and

	Water.	Cream.	Sugar.	Casein.	Fat.	Ash.	Water.
Grade	14·13	5·12	3·45	4·19	0·68	86·56	
Grade	9·86	5·05	3·77	4·30	0·67	86·81	

ANALYSES OF BEEF, MILK AND SKIM-MILK.

Wolff's Tables.

Beef.	Whole Milk.	Milk Skimmed 12 Hours from Milking.	Milk Skimmed in 36 Hours.
Sharples.			Way.
15·00	8·94	5·30	4·00
30·00	9·36	5·66	5·90
5·00	0·67	0·70	0·78
50·00	86·08	89·23	89·03

Average Analyses of Milk from Thoroughbred and Grade Cows, contributed by A. L. Murdock and Professor S. P. Sharples, of Boston. Of our Cows, one per cent. are Thorough-bred, and ten per cent. are Grade.

Thorough-bred	Flesh Forming
Grade	Heat Producing
	Mineral
	Water

So that when beef is worth 25 cts. per pound with the bone removed, fresh milk is worth 14 cts.; skim, 12 hours old, 10¾ cts.; and skim-milk, 36 hours old, 10 cts. per quart. Skim-milk when fed to hogs is worth one-half a cent per quart, and 100,000,000 quarts are fed annually in Massachusetts, which can be sold at one-half price of pure milk, if the cream is raised in 12 hours.

BONES AND SUPERPHOSPHATES.

PLEASE answer the following queries:

1. What chemical changes take place when 100 pounds of raw ground bone are dissolved with sulphuric acid? Is sulphate of lime (gypsum) formed, and what proportion?

2. Is bone made more available for plant food by the use of acid, and if so, why is it ever used undissolved?

3. What is the difference between and relative value of dissolved bone and dissolved South Carolina rock?

4. Is it advisable to mix gypsum with superphosphate before using, or is there a sufficient quantity already present?

5. Is it proper to mix wood ashes with hen manure, and if not, what are the chemical changes that make it improper?

6. Is the strength of the odor from a superphosphate a good test of its agricultural value?

7. In an analysis like the following, where only from 13½ to 18½ per cent. of available chemicals is given, what is the probable value of the balance of the 100 parts for agricultural purposes?

Available phosphoric acid	8	to 12	per cent.
Ammonia (potential)	2	to 2½	do.
Potash (KO)	3½	to 4	do.

You will oblige me and probably many others by giving full and practical answers to the above.—C. E. L., *Berryville, Va.*

[Answer by PROF. S. W. JOHNSON, Sheffield Scientific School.]

1. Raw ground bone is somewhat variable in composition, but contains about as follows:

	Per cent.
Water	10
Organic matter, gelatine, and fat *	30
Sand and impurities	4
Phosphates of lime and magnesia †	50
Carbonate of lime	6

When finely ground raw bones are treated with somewhat

* With nitrogen, 3 per cent.
† With phosphoric acid, 24 per cent.

diluted sulphuric acid, they are not dissolved, in the strict sense, but they are disintegrated, and their phosphates are so changed chemically as to be dissolved upon adding a large quantity of water. The chemical changes depend somewhat on the quantity of sulphuric acid that is used. For agricultural purposes, the point is to render a good share of the phosphoric acid soluble in water as cheaply as possible. To accomplish this, the bone must be mixed with diluted sulphuric acid enough to take away from the bone earth (tricalcic phosphate) two-thirds of its lime, making therewith sulphate of lime (gypsum), and leaving superphosphate of lime (monocalcic phosphate). Before the sulphuric acid will touch the phosphate it must decompose the carbonate present, converting its lime into sulphate. Six pounds of carbonate of lime require, in round numbers, 6 pounds of oil of vitriol for this purpose, and the product will be 8 pounds of gypsum. To convert the 50 pounds of phosphates into superphosphate will require 26 pounds of oil of vitriol, and the result of this conversion will be 40 pounds of monocalcic phosphate and 48½ pounds of gypsum. The 56 pounds of phosphates and carbonates will thus yield, with 26 pounds of oil of vitriol, 50½ pounds of gypsum and 40 pounds of monocalcic phosphate. The excess of the latter 90½ pounds over the former 82 pounds is due to 18½ pounds of water which the gypsum and the monocalcic phosphate take into chemical combination, and which is provided for by diluting the sulphuric acid with twice its bulk of water before mixing with the bone.

The above result is never quite reached, because, owing to the coarseness of the bone and the bulk of the gypsum formed, perfect admixture and contact between the phosphates and the sulphuric acid is not attainable. More sulphuric acid will effect complete solution of the phosphoric acid, but in practice that is not advisable.

2. Bone is certainly made more available as plant food, because it is made more soluble, and thus admits of immediate distribution to the soil. The effect is not to make the phosphoric acid any better for the plant, but to make a given quantity of it feed more plants in less time than would happen with bones not sulphated. The nitrogen of the bones is also rendered more rapidly accessible to plants by this treatment. The ultimate effect of acting on bones with sulphuric acid is the same as that of extreme pulverization. Bone flour is as actual and effectual a fertilizer as the sulphated bone.

The reason why bones are ever used undissolved is simply because under many circumstances it cost less to do so. In other words, a given amount of money and labor expended in raw bone often goes further and does better than when put into sulphated bones.

3. The difference is, that dissolved bones contain 2 to 4 per cent. of nitrogen, of which South Carolina rock is destitute. The relative *money value* depends of course upon how they are made, or what quantities of nitrogen and soluble phosphoric acid they contain. Nitrogen in sulphated bone is worth 20 cents per pound in our commercial centers, while soluble phosphoric acid is worth but 12½ cents. The relative fertilizing value depends upon the soils and crops they are applied to. When nitrogen alone is needed to make a crop, the South Carolina rock would of course have no fertilizing value.

4. There is no occasion to add gypsum, unless more is wanted than the usually small dose of dissolved bone would supply.

5. The white portions of bird dung consist of *urate of ammonia*. If mixed with quicklime, ammonia will be copiously set free, and go off as gas, urate of lime remaining; but if the mixture be mixed and covered with abundance of moist loam, the ammonia will be retained in the latter.

6. No, none whatever. The richest superphosphates may be quite free from strong odor.

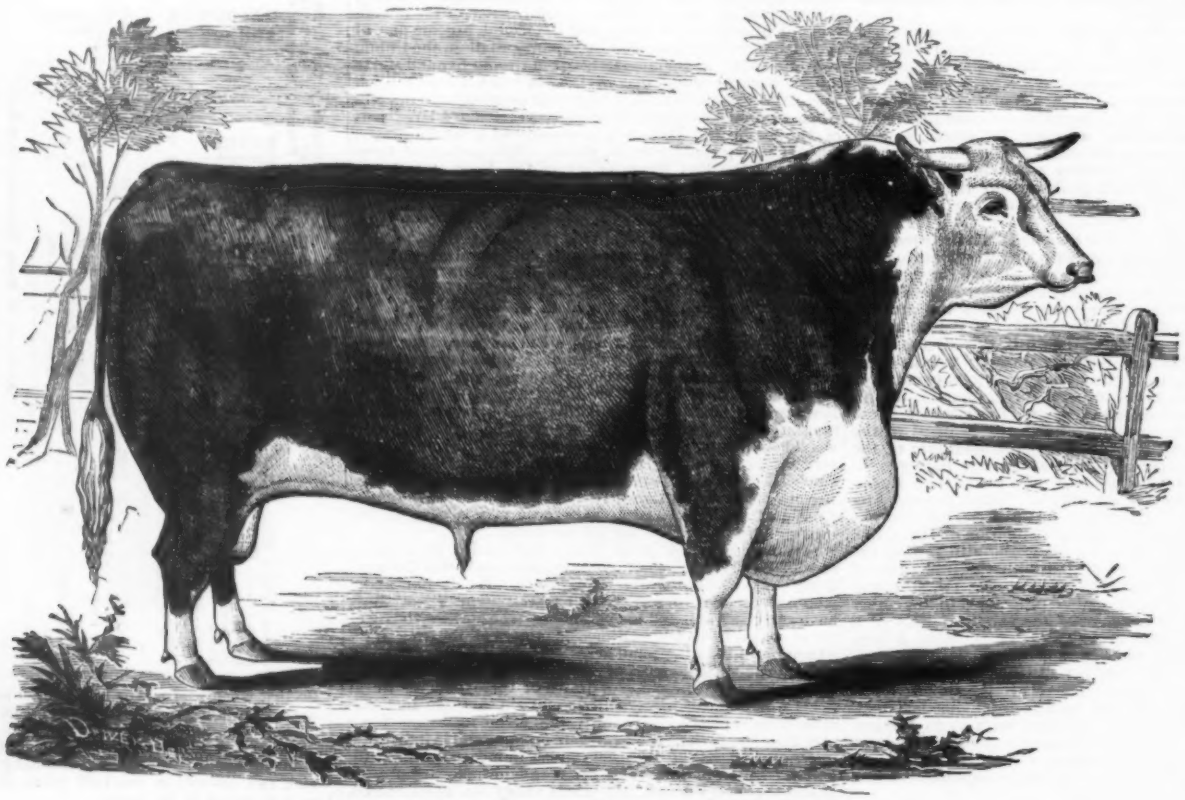
7. Eight to twelve per cent. of available phosphoric acid usually implies 40 to 50 per cent. of gypsum; 2 to 2½ of potential ammonia implies 30 or 40 of animal matter; and 3½ to 4 of "potash" implies 8 to 12 of sulphate or muriate of potash. Then 20 per cent. of moisture and 1 to 5 of sand or soil are practically inseparable from most commercial fertilizers.—*Country Gentleman.*

HEREFORD CATTLE.

THOUGH the Hereford breed of cattle has not as yet been extensively introduced into this section of the country, its excellences are commanding the situation at many other points, notably in England, Australia, South America, and in our own Western country. It is a matter of record that not only in the London market have they been quoted from one to two cents a pound above the Shorthorns, but the records of the Smithfield show will witness that the Hereford steer has a record over the Shorthorn, and the same record shows that the Hereford steer has made as good weights as the Shorthorns, at any given age. And now the Bath and West of England Society has awarded the two champion prizes, for best male and female in the show, to the Herefords. Coupling this with the fact that during the same record he has always brought the better price, and another established fact that he has always been a more economical feeder and grazer, is it not strange that the press and agricultural societies have not been more ready to encourage them?

A recent sale of 100 Hereford bulls in England for shipment to the grazing regions of Buenos Ayres shows the estimation in which this famous stock is there held. The Herefords have made more rapid progress in public favor at the West, in the last five years, than ever was made by any other breed of cattle in America in the same time. In Colorado and Wyoming, there are several herds of from 20,000 to 60,000 head, that are using all the Hereford bulls they can get; and already at the Union Stock Yards at Chicago, and at the St. Louis and Kansas City Stock Yards, these steers are commanding the top prices, while five years ago they were not known in these yards. In five years more they will be quoted at all of these markets, as they have been in the London market in England for the last 100 years or thereabouts.

The Hereford cattle are tough, hardy, and thrive on a diet both in quality and quantity that would be unprofitable in the Shorthorns. The cattle are of very large size, make excellent beef, are fair milkers, especially when crossed with other kinds, and are withal quite handsome, being red bodied with white markings and a white face, the latter being an invariable mark of the kind. Among the herds of cattle exhibited at the recent New England Fair at Worcester, none attracted more attention than the herd of Herefords owned by J. S. Hawes, of South Vassalboro, Me. He showed thirteen Herefords, among which was a thoroughbred bull, Highland Chief, the largest on the grounds, but five years old, and weighing 3,000 pounds, having a length of eleven and a girt of nine feet, one bull and two heifers, also three calves, five months old, which he engaged to parties who design sending them to a ranche in the West, where they are breeding stock to ship to England. The price stipulated was $300 for the trio. The Hereford cows on exhibition weighed between 1,500 and 1,600 pounds. An enlarged popularity in this country is predicted for the Hereford breed of cattle.—*Boston Cultivator.*



THE HEREFORD BREED OF CATTLE.

INDIAN OIL TRADE.

THE export of oils (according to an official report) does not show so much progress as might be wished. The value of the oils in 1872–73 was 33½ lacs of rupees, and in 1876–77 it amounted to only 37¾ lacs of rupees, after having in the year previous reached 42½ lacs of rupees. Very little animal, essential, or mineral oil is exported from the country, the shipments consisting mostly of the fixed vegetable oils, and among these castor oil and the dregs of gingelly oil occupy the most important place. More than half of the castor oil is sent to the United Kingdom, and of the rest the greater part is taken by Australia, the Straits, and Mauritius. It is almost exclusively exported from Bengal. The dregs of gingelly oil are an export from Madras to Ceylon. It is strange that as yet more attention has not been given to the manufacture of oil in India with a view to export. The country exports oil-seeds to the value of 5,500,000 sterling, leaving the conversion of these seeds into oil to be done in the countries which take them. It is obvious that it loses a good deal by sending away the raw material in this way instead of making it into oil, for it has to pay a heavy freight on that portion of the seeds which might with advantage remain in the country after the oil has been expressed and sent away. By not keeping this refuse much valuable matter is lost for manure and cattle-food, and heavy risk incurred of deterioration of the cargoes by the heating of the seeds in transit. No doubt if the oil were expressed by natives without European supervision, it might be difficult to find a market for it, owing to apprehensions of fraudulent adulteration; but if Europeans were to set up oil-mills, and attach a mark to the oils expressed by them, that mark being a guarantee for fixed standard quality, we might with great benefit to all concerned in the trade and to the country at large, more especially to the live stock of the agricultural community, find the exports of seeds reduced by one-half, while the exports of oil were correspondingly increased. It is time for a change in the oil seed trade, for the unnecessary export year after year of at least 4,000,000 cwts. of material for oilcake, while the cattle of India die off like flies in a frost when drought destroys the scanty pasture which is their only sustenance, is the reverse of good policy and good sense. The export of oil-seeds has increased enormously during the last three years, as the following figures testify:

	cwts.	rs.
1871–72	5,124,765	2,72,81,272
1872–73	2,779,243	1,50,82,410
1873–74	4,432,270	2,36,14,508
1874–75	6,074,756	3,23,59,503
1875–76	10,506,822	5,46,19,818
1876–77	9,582,865	5,31,91,240

The diminution of the exports in the last of these years was the result of an unfavorable outturn of the harvest of some kinds, owing to the deficient rainfall of last winter; but the exports of the first six months of the current year promise a very large trade before the end of next March, the quantity already exported amounting to very nearly 8,000,000 cwts. The details of the most important of the different kinds of seeds exported are shown in the table attached:

	1875–77	
	cwts.	rs.
Linseed	5,614,617	3,01,54,374
Rapeseed	2,088,760	1,14,29,244
Teel or gingelly	1,307,815	86,82,937
Poppy	351,133	18,43,647
	1875–76	
	cwts.	rs.
Linseed	6,282,512	3,31,71,635
Rapeseed	2,241,843	1,08,48,208
Teel or gingelly	1,409,908	78,74,782
Poppy	253,326	13,54,194

The four kinds of seeds here mentioned constituted 97·9 per cent. of the whole trade of the year. The exports of linseed were thus distributed:

3,740,362 cwts. to England, 743,897 cwts. to the United States, 726,495 cwts. to France (an extremely large increase in the trade as compared with the previous year), 233,644 cwts. to Belgium, 88,386 cwts. to Holland, 75,351 cwts. to Egypt. Of the rapeseed, more than 1,500,000 cwts. were sent to England, 320,354 cwts. to France, 222,487 cwts. to Belgium, 42,900 cwts. to Germany. The bulk of the exports of teel or gingelly seed is sent to France, which took 1,172,219 cwts. during the year, and 110,187 cwts. went to Italy. In both countries this oil is extensively employed as a substitute for olive oil and in the manufacture of soap. The exports of poppy seed were sent to France and England—France taking 185,964 cwts. and England 164,748 cwts. The seed trade is mostly in the hands of the Greeks, and is of a very speculative character.—*London Grocer.*

SOME idea may be formed of the progress of China within recent years from the fact that of the 9,268,000 tons of foreign-built vessels engaged in the local carrying trade between the treaty ports, the Chinese themselves own 3,955,000.